NATURE MAGAZINE

une-July, 1946 35 Cents Vol. 39, No. 6

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Bulletins Received

The Whitefish Fishery of Lakes Huron and Michigan with Special Reference to the Deep-Trap-Net Fishery. By John Van Oosten, Ralph Hile and Frank Jobes. Fishery Bulletin No. 40, U. S. Fish and Wildlife Service. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 35 cents.

The Du Pont Company's Part in the National Security Program. An interesting and enlightening account of the activities and contributions of a great and diverse business organization. Available from E. I. Du Pont de Nemours and Company, Wilmington, Delaware.

The Story of Conservation in New York. Vol. 39, No. 4, March, 1946, Cornell Rural School Leaflet. An original and stimulating discussion of conservation. Department of Rural Education, Cornell University, Ithaca, New York. 25 cents.

A Descriptive Catalog of the Shore Fishes of Peru. By Samuel F. Hildebrand. 530 pages. A valuable work for ichthyologists. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. $1.25.

The Fresh-Water Fishes of Siam, or Thailand. By Hugh M. Smith. 622 pages. Important ichthological work. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. $1.50.

The New Microscopes, by Dr. R. E. Seidel and M. Elizabeth Winter. Publication 3781 of the Smithsonian Institution. U. S. Government Printing Office, Washington 25, D. C.

Let's See, by E. Laurence Palmer. Volume 39, Number 3, of the Cornell Rural School Leaflet series. New York State College of Agriculture, Cornell University, Ithaca, New York. 25 cents.

Commemoration through Community Services: Trends in Living Memorials, American City Magazine, 470 Fourth Avenue, New York 16, New York.

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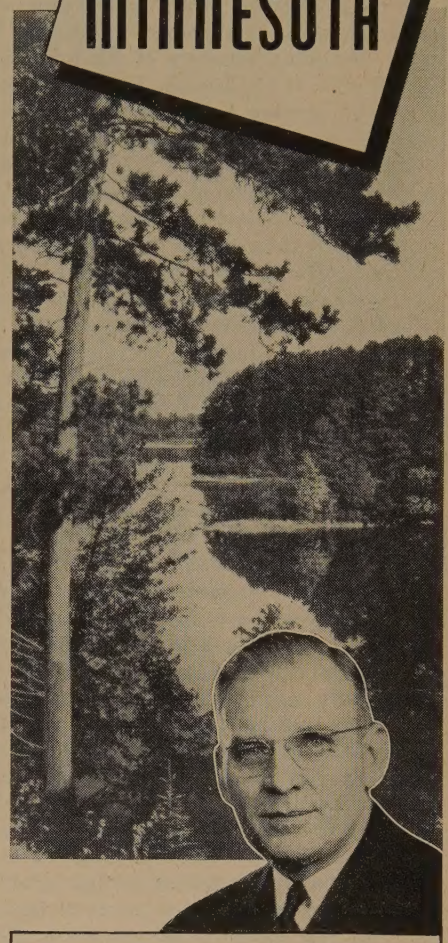

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Nature in Print

By HOWARD ZAHNISER

READERS of *Nature Magazine* must indeed be well aware of the value of verse in contributing to a full representation of what Nature may mean to them. For some time now the good editor of this publication (and I trust he leaves the adjectives in this sentence as written) has been among the more discerning members of his profession in setting aside liberal plots of his demesne for cultivation by the poets. As a result his readers have had this subject matter of Nature touched—as it properly should be—with emotion, and the poets themselves have had the fuller opportunity, so essential to them, of a medium of expression.

Strangely enough, I understand it was somewhat courageous to open thus the pages of a Nature publication to poetry, and the editor himself has confessed, in his "Contents Noted," the surprise he so pleasantly realized in receiving a more than adequate offering of high quality verse. Somehow or other verse had not so long ago become too predominantly the first resort of mediocre would-be writers, always ready to overwhelm any editor who left an opening, and only love rivaled Nature as the favorite theme of such articulately aspiring tyros. It took courage to open the pages of *Nature Magazine* to poetry, but (as only the courageous can) the editor soon found that in his valor there was discretion too, and he thus revealed a new avenue of appreciation to his readers.

The Washington Post, one of the leading morning newspapers of the country, has made a similar venture, and with similar success—as is apparent in a recently published volume, *This Is My America: Poems from The Washington Post,* selected and arranged by Kenton Kilmer. For the past half-dozen years or so Mr. Kilmer has been cooperating with the publisher, Eugene Meyer, by making daily selections—"on the assumption," he writes, "that the poets of America would support the effort to get good poetry before the newspaper-reading public." This support has indeed been adequate, and Mr. Kilmer, in his foreword to *This Is My America,* expresses "deep gratitude to the thousand or so whose offerings have been accepted, and equally to those, numbering perhaps a hundred thousand, who have sent poems in only to get them back." Granted this support, the real success of the venture in a broad sense is probably, as for *Nature Magazine,* in touching the reader with true, valid emotion. As Mr. Kilmer observes, "it is good for us to have an emotional, as well as intellectual, realization of the grandeur of the land in which we live."

With this conviction Mr. Kilmer has based and arranged his first collection on William A. Brewer's prose-poem "This Is My America," using each of its twenty-one paragraph-verses as the theme for a group of poems. This itself is a nice idea, an evidence of Mr. Kilmer's imagination and discrimination. The book as a whole, as a unit, thus becomes something of special interest to the readers of this magazine, and it contains, of course, many individual poems that might well have been published here.

As a matter of fact some of the poets will be familiar to *Nature Magazine* readers. Paul H. Oehser, with a sure poetic hand, expresses—in "There Is A Way"—the regard for natural surroundings that is part of the gentle kindliness and perception of what is real which he has shown at various times in these pages—

"There is a way the creek curls through the low hills,
And a way the road follows along the sparkling creek,
And the hills lap themselves over one another:
On and on to the end of the world, farther
Than the eyes can reach or the voice can speak;
"And the sugar maples make canopies of shade
Over the country road in quarter-mile lengths
(Sons of some grandsire's ancient thoughtfulness),
Till, passing between the rows, you stop to bless
Their rugged trunks and feel their thousand strengths.

* * * * *

"Take me to this place where the hills lie thus to the sky,
And though I see no face to tell it by
I shall know for certain that I am home."

Lansing Christman describes, with his exquisite simplicity, a scene of early spring, in "Mirror for the Clouds"—

"This woodland path that follows
And winds along the south slope
Was the first to feel the kind
Soft hands of spring; they brushed
The old brown leaves with sun,
And softened them with rain.
They brought hepatica blooms
And painted the carpets of the woods
In pink and white and blue,
Colors like those of the sky
Brought down to earth, or like
The clear summer stream
That makes a mirror for the clouds."

Daniel Smythe, whose strength of utterance and sensitiveness to both Nature and poesy we have several times enjoyed, writes in twenty lines of well-modulated blank verse—called "Leaving the Mountains"—a lyric description of certain gray crags "that carried silently their shawl of forests"—

"These are the mountains; when we come to leave,
We with our tiny feet on roads like threads,
We look back at them, pillowed in the sky,
A storm acquainted with an age of seasons.
They make within our memory a wall,
Burdened with trees and moss and giant clouds.
Beyond that wall of peaks and curves, we stand
Looking through sunlight; and no words are needed."

Mr. Smythe, whose six poems outnumber the poems of any other in this collection—except the half-dozen by Charles Malam—has also a versatility with which we are familiar—the expression of his sense of appropriateness, which leads him, for example, to stately blank verse for mountains but to gentle rhyming quatrains for "The Goldfinches"—

"Through space that is chill and frost-filed,
Suddenly a flock of tiny birds
Swoops down . . . The branches are beguiled
With trills and tender words.

"They are so gentle; their song goes
Twittering along the limbs.
They bring alive what the pear tree shows
And what the cold sky rims.

"What care they for the snow's hard ply
Or the leaves stretched taut on the ground?
The tree's horn blows to the bitter sky
Medleys of gentle sound."

Fortunate it is to know Dan Smythe and to have his poems in bound volumes. His own first book *Steep Acres,* published just before the war, brought deep appreciation, and, also, anticipations for many more. These expectations brought later an added tenseness to the war years, when "Sergeant" Smythe was advancing with the infantry of the European invasion forces, without the benefit of any special dispensation for poets—for either their lives or their socially valuable sensitiveness. Now he is back—and valiantly entitles his second volume of poems *Only More Sure,* after Robert Frost's verses—

"They will not find me changed from him they knew,
Only more sure of all I thought was true."

The fifty-four poems in *Only More Sure*—in verse forms that

fittingly vary with their subjects and moods—are a witness of the mind of a poet going with nobility through all the tenseness, the hazards, and degradations of war. "These poems," says William Rose Benet in a foreword, "have taken me to where the writer was, made me see a moment with his eyes."

One of these poems—"I Walk Afar"—first published in *The New York Times* and from there copied out on a sheet of paper, has been in and out of my wallet so many times that creases have become perforations—the paper barely surviving long enough to become a book mark in this volume, so often has the poem's assurance been welcome. Surely there is much hope when a man, in the midst of horror and hatred, can write—

"I walk afar among strange ways and scenes,
And see how everything is lost in wars.
From storm to storm, I ponder what each means,
And stare, at night, upon the unmoved stars.
I tell myself: live on in foreign lands;
Sleep where you may, on wood or field or stone.
Still from the past, there are these certain hands
That touch and keep me from ever being alone.

Home, like a steady thought, is in my mind.
It overshadows all the cluttered field
To which my present life has been assigned.
My ways are guided and will never yield,
For love has touched me with its certainty
No matter where my marching feet may be."

It may seem strange (and it is a marvel) that Sergeant Smythe could ever have written these poems in the circumstances that surrounded him. He seems to explain this in part in a remarkable composition entitled "Comfort of Words"—concluding as follows (in an atmosphere of hate):

"Words are a comfort; I can speak my love
That moves in me, for all things in my days,
For people met in corners of the world,
And nature with her sureness. . . . In these words
There is my love that waits and hopes to know."

Throughout this book there is much to be learned of "nature with her sureness," and it is to be hoped that many will come to have the sort of acquaintance with *Only More Sure* that can never be enjoyed through another's reading, but only through possession. Samplings are far from adequate, but it may be noted that Daniel Smythe writing of "Cherry Blossoms" in war is one who concludes by singing:

"I see the world a silver rout,
A light that we have spoken of.
And who will shut this beauty out
Denying hope, and faith, and love?"

And it may be noted too that Daniel Smythe confirms the conviction which we who sought to conserve at home had in feeling that a great service to the soldier would be the preservation of the America he had always known.

And it is for men who feel this way that Kenton Kilmer has especially prepared *This Is My America.* "The picture of America in this selection," he writes, "I have considered particularly appropriate at this time, as a welcome home to the returned soldier, or, still more essential, a gift from home, and of home, to the other soldier who must still for a time be away from his family and his familiar scenes." But its 144 poems are also appropriate at this time for all of us, and its evidence of poetry alive in even our daily press is a timely and welcome reassurance in a world of reconstruction. It expresses the noblest patriotism we know—the patriotism that carried Dan Smythe with sureness. This is a patriotism that arises not from narrow nationalism and even despises racial arrogance. It is a patriotism that arises rather from love of the land, arises thus from an influence that can be world wide. We can all sing with Nathan Zimelman in the concluding poem of *This Is My America:*

"It is a mountain
My country,
It is a mountain and a river
And a plain,
Gold where the wheat has caught the sun.
It is a mountain and a river
And a people
Who have known the goodness
Of the spring holding earth.
It is a man,
And a woman
Who took a dream
And made a nation.
It is a word,
My country,
A word that is a river
And a plain,
A mountain
And a dream
And a song on a free man's lips.
It is a man and a woman
A word and a song
And a people's dream.
It is my country."

This Is My America: Poems from The Washington Post. Selected and Arranged by Kenton Kilmer. The Washington Post, Washington, D. C. 1946. 180 pp. $2.50.

Only More Sure. By Daniel Smythe. The Murray Press: 16 Beacon Street, Boston 8, Mass. 1946. Unnumbered pages, with foreword by William Rose Benet. $1.50.

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To Stimulate Public Interest in Every Phase of Nature and the Out-Of-Doors, and Devoted to the Practical Conservation of the Great National Resources of America

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Fewer Ducks—Less Shooting

At the North American Wildlife Conference Albert M. Day, Director of the U. S. Fish and Wildlife Service, warned that the numbers of migratory waterfowl indicated that the increased army of hunters must accept shorter seasons and reduced bags in 1946. Following upon Mr. Day's forecast of the situation, the National Audubon Society declared that "the prevailing waterfowl situation calls for drastic action," and asserted that 1946 will provide a year of acid test that will determine whether we can face the facts of the situation. The Society urges that the federal government consider reducing the 1946-7 waterfowl hunting season from eighty to thirty days, and that the bag limit be reduced from ten to five birds a day, with the possession limit the same as the bag limit. We believe that this proposal is none too drastic; that the cycle is downward, at this time, so far as migratory waterfowl are concerned; that the number of duck hunters will establish a still newer "high" than the 1,700,000 in 1945-6. We therefore heartily endorse the National Audubon Society proposal as a maximum season and bag for 1946.

Colored Bird Slides

The National Audubon Society, 1006 Fifth Avenue, New York 28, New York, announces a series of two-inch by two-inch, full-color slides of birds made from bird paintings by Major Allan Brooks. There are 150 subjects in all, available in seven sets of twenty each and one set of ten. Details as to cost and species of birds included may be obtained by writing to the address given above.

Wild Flower

During 1945 pressure of war conditions forced the suspension of publication of *Wild Flower*, official quarterly publication of the Wild Flower Preservation Society. In January, 1946, however, the magazine made its reappearance under the editorship of Dr. Earl L. Core, Professor of Botany at West Virginia University. The Society also announces the appointment of George R. Bowne as the full-time executive secretary with headquarters at 3740 Oliver Street, N. W., Washington 15, D. C.

Shade Tree Leaflet

Twenty-six species of shade trees of street and lawn are described in a leaflet published by the New York State College of Forestry at Syracuse University, Syracuse, New York. The leaflet was written by Dr. Laurie D. Cox, and deals only with hardwood trees, describing each tree, the type of location for which it is adapted and the kind of soil in which it should be planted. The leaflet is available on request.

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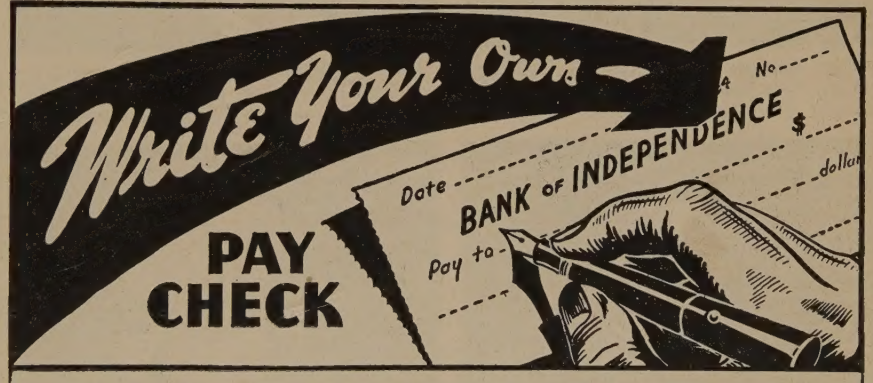

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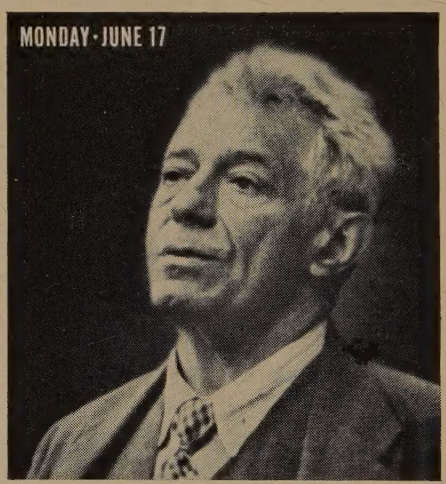
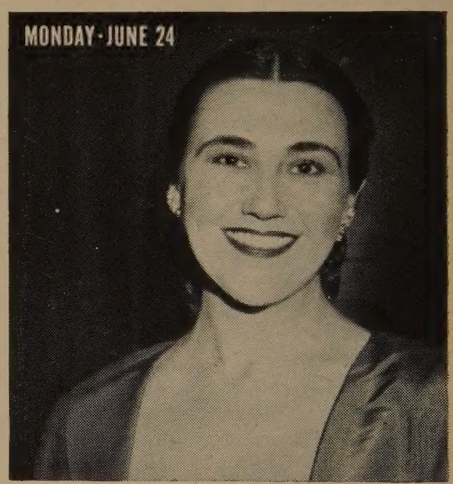
BING CROSBY	OSCAR LEVANT	BIDU SAYAO
NELSON EDDY	LAURITZ MELCHIOR	MAGGIE TEYTE
BENNY GOODMAN	JAMES MELTON	BLANCHE THEBOM
TITO GUIZAR	EZIO PINZA	HELEN TRAUBEL

DONALD VOORHEES AND THE BELL TELEPHONE ORCHESTRA

JAMES MELTON—One of America's favorite tenors. First New York appearance at Roxy Theatre. Metropolitan Opera debut, 1942.

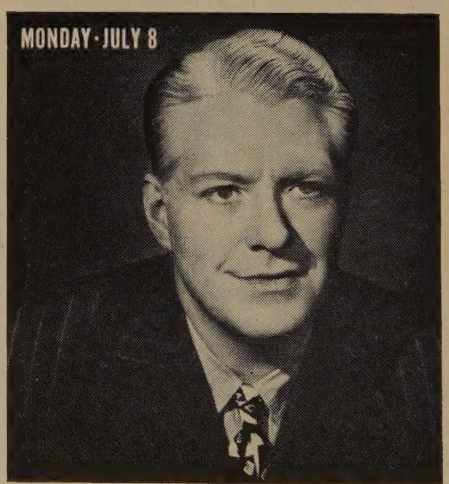


FRITZ KREISLER—Distinguished violinist and composer. Made his first radio appearance at sixty-nine on "The Telephone Hour."

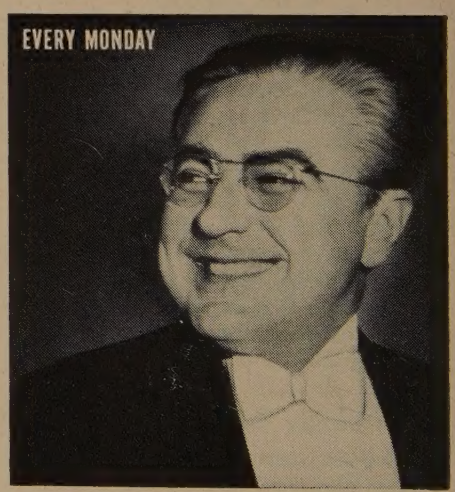


BLANCHE THEBOM—Lovely mezzo-soprano of the Metropolitan. Discovery followed her singing at a ship's concert while on vacation.

BING CROSBY—The beloved Bing of screen and radio has a distinct place in American music and in the hearts of millions of listeners.



NELSON EDDY—Star of screen, radio and the concert stage. Voted in 1945 "the best male singer regularly featured on the air."



DONALD VOORHEES—Talented conductor of the Bell Telephone Orchestra, long identified with the great musical programs in radio.

All appearances subject to change

BELL TELEPHONE SYSTEM

Every Monday Night over NBC (See your local newspaper for time and station)

Contents Noted

URGING other readers to "top this one", the Wildlife Editor" of *Prairie Farmer* pridefully reports that Lyman Johnson of Fithian, Illinois, has dispatched sixty-three foxes from his acreage, and publishes a picture of Lyman draped with fox pelts to prove it. He also reports Lyman as writing: "As far as I know there are only four and not over five foxes left in the seven square mile area that I've been hunting in. I've checked up on them every time it has snowed. One has a toe missing, one has a broken leg, and I don't know much about the other two." It will be interesting to hear—if we ever do—through the "Wildlife Editor" about the resulting rodent population of Lyman's seven square miles, now that one of the most important animals in controlling harmful rodents has been virtually wiped out. Yes, education in wildlife conservation still has a long way to go.

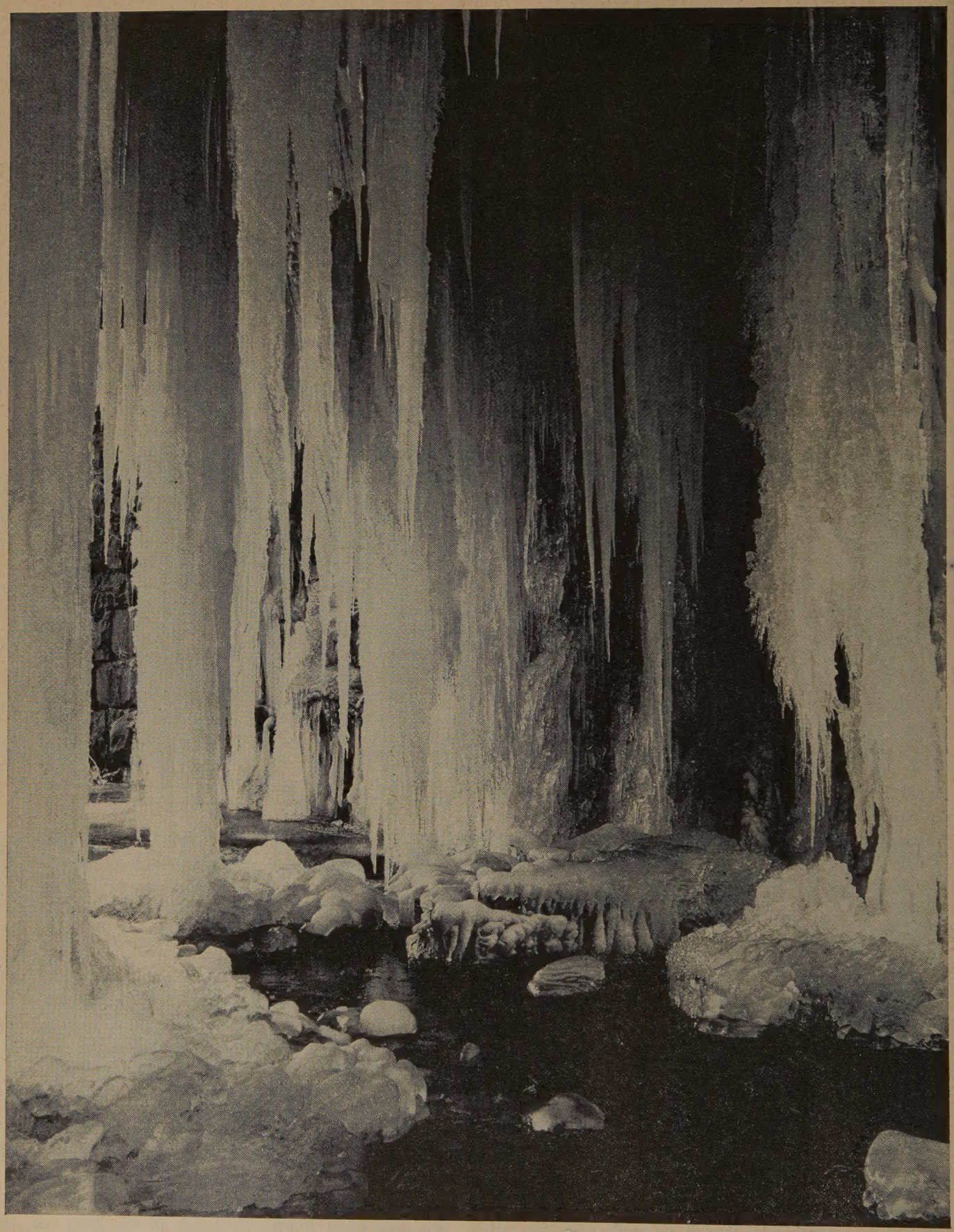
RENEWED interested in Shetland ponies is reported by the U. S. Department of Agriculture, so much so that a mimeographed report on their history, uses and care has been prepared. Native to the Shetland Islands, rocky, rough and sparsely-grassed dots on the map two hundred miles north of Scotland, the ponies are small by reason of these conditions. Where food is plentiful they tend to grow larger. But their inhospitable environment seems to have bred in them gentleness, amenability to handling, hardiness and longevity. They are used in British coal mines, and as pack and draft animals in Britain and on nearby isles. They should not be ridden until two years old, why we do not know.

ONE OF our friends and critics describes as "a gruesome little piece" the item in our issue of November, 1945, describing observation of some tiny ants that had gotten involved in a well-filled ink bottle and proved to have remarkable powers of survival. "How a cultivated person could have diverted himself by the aimless cruelty here set forth is incomprehensible, yet it is better that the incident should be written down and printed, since we all ought to know the true condition of the mind and 'heart' of our species—and how constantly in everyday life most of us rehearse barbarities falsely associated only with war," writes our correspondent, Miss Marian Storm of Mexico. Since we printed the item without comment, she wonders if we "approve the torture of insects, even?" We will confess that we did not think of this note in terms of cruelty, and we wonder whether other readers did.

WE HAVE no real reason to put in our two cents' worth with respect to through railroad service from coast to coast, except that if we never have to ride on a Parmlee Transfer bus in Chicago it will be soon enough. But we have always had an affection for the Chesapeake and Ohio Railway ever since it created "Chessie," the cat, And we liked its advertisement, designed to break through the existing situation and entitled "A Hog Can Cross the Country without Changing Trains—But YOU Can't!" Now the C. and O., which admits it is not the most logical road to offer through service, has decided to pry the lid off the mystery of why YOU cannot keep right on going West from eastern points through Chicago, St. Louis and New Orleans, and vice versa. It has always been a mystery to us, and a mighty silly piece of transportation practice. So when the Chairman of the Board of the C. and O. appeals to leaders of public opinion for an expression of sentiment we step slightly out of character and say, "Go to it, Chessie."

DURING March and April, Harold Gray, creator of the "comic" strip "Little Orphan Annie", used the adventures of that peripatetic and ageless moppet as a means for introducing some conservation doctrine. Mr. Gray seems to have a penchant for excursions into homespun philosophy, sociology, and other fields, during the more quiet interludes between appearances of Punjab and other exciting characters. The cartoonist presented some good thoughts on preservation of habitat and maintenance of the balance of Nature, even putting in a good word for a blacksnake. Then he went haywire with a series of strips condemning all hawks as bad, and urging the destruction of hawks of whatever kind. It may be that he thinks there is only one kind of hawk, but he did a tremendous amount of damage to the long years of educational work in behalf of the beneficial hawks. Perhaps, in the long run, it would be as well if comic-strip cartoonists stuck to their Gravel Gerties and Dragon Ladies, and left deeper and more complicated subjects alone.

R. W. W.



PHOTOGRAPH BY DEVEREUX BUTCHER

Nothing that man may do with ice can equal beauty such as this, when Nature, an architect with frigid fingers, works on dripping water. An abandoned aqueduct over the old Lehigh canal beside the Delaware furnished the material.

Shallow clay pans were set out on cool nights by the Egyptians, and thin layers of ice were gathered in the morning for use in refrigeration.

Alexander the Great took care of his comfort by having trenches dug and filled with snow to cool his wine during his Indian Campaign.

Ice Ages, Past and Present

By EDNA H. EVANS

Drawings of the History of Ice, Courtesy of National Association of Ice Industries.

THE TWENTIETH century has been called many things—the age of steam, of steel, of electricity, of aviation, and most recently of atomic energy. It also might be called the age of refrigeration—an entirely different kind of ice age than the world has ever before experienced.

Ice, which is merely frozen water, possesses such vast possibilities that man only now is beginning to recognize and take advantage of them.

Today, ice is an easily obtainable necessity that costs little. But this has not always been the case. Time was when a pound of ice was so costly that only merchant princes and men of great wealth could afford to buy it. Farther back in history, cool drinks and iced foods were luxuries that only the mightiest of rulers could command.

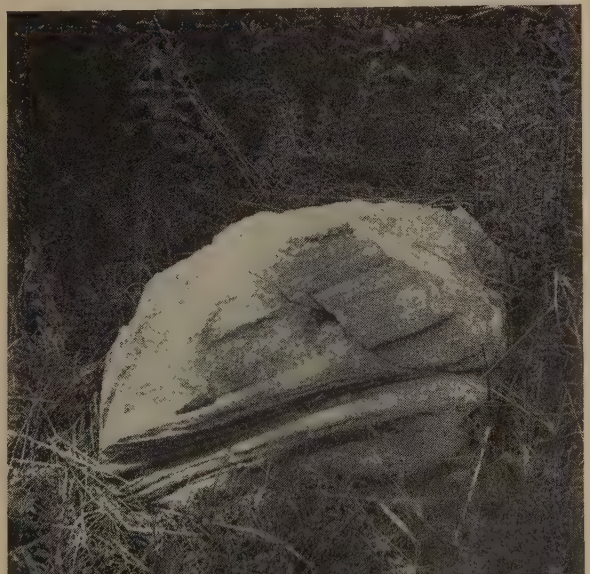
Ice is, at any time, both a preserver and a destroyer. It is a vast storehouse of water, one of the world's greatest natural resources. Yet, when it releases that store too rapidly, floods and disaster result. It is a preserver, too, and perishables locked in its crystal depths will last indefinitely.

It is an architect and a builder, for it has shaped the face of the earth, rounding off corners or lopping off hilltops, and heaping up the material somewhere else. It is destructive in this work, also, for it sometimes scrapes off fertile top soil and leaves nothing but barren rocks and pebbles.

As a source of recreation, ice skating, ice boating and associated winter sports provide entertainment and exercise for thousands. A frozen pond, sparkling in the wintry daylight, is a thing of beauty, as are the great ice fields of the far North. But when loose at sea the great floating chunks of ice known as icebergs are wreckers, as the long roll of lost ships indicates.

Ice is used in modern surgery as a pain killer, yet it can cause pain, too, as anyone who has ever experienced the ache and tingle of frostbitten feet, ears or fingers can eloquently testify.

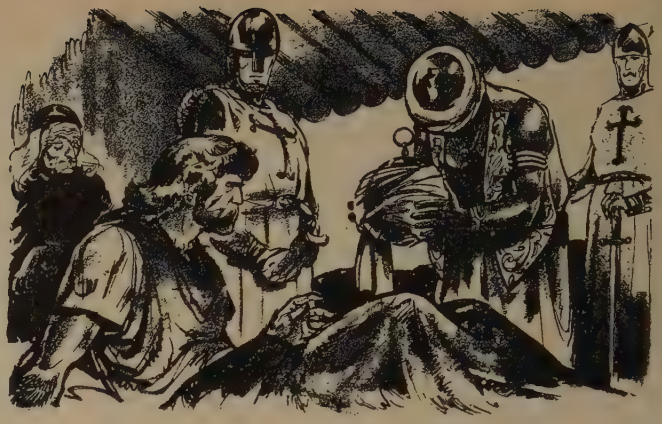
Handwriting of the ice age. This ice-planed rock tells of the day when the great ice cap reached down over much of North America.



In addition to this twentieth century ice age—this age of refrigeration—several other ice ages have come and gone. Geologists say that the world is only now progressing out of the most recent of these older ice ages, and no one will predict whether other icy eras lie ahead. We have moved such a short distance from the last glacial age that a drop of nine degrees in the world's yearly average temperature would serve to bring on another.

Many parts of the northern hemisphere owe their present

Romans brought snow from Mt. Albanus, packing it into pits and covering it with straw and prunings from trees. Later it was cut out for the elite.



Richard, the Lion-Hearted, lay sick of fever on one of his Crusades, and Saladin, leader of the Mohammedans, sent him a delicious frozen sherbet.

physical state to the crushing, grinding and smoothing powers of the great ice sheets, which four, or possibly five times, crept over them. Each ice age is said to have lasted about fifty thousand years, with pleasant interglacial periods, perhaps several times as long, sandwiched in between.

The last ice age ended about twenty thousand years ago and since that time the climate has been growing milder, with occasional setbacks. Those great ice sheets retreated slowly, reluctantly, and are still retreating. Ten thousand years ago, geologists say, the site of Stockholm, Sweden, was still covered with ice. Today, remains of the glaciers form the Greenland ice cap and cover countless islands in the far North.

All told, there are about eight hundred thousand square miles of ice-covered land in the Arctic, plus an unmelting stretch of polar cap-ice over some two million square miles of the Arctic Sea. At the other end of the globe the great south polar continent of Antarctica is covered by a sheet of five million square miles of ice.

Icebergs, which menace the sea lanes, break away or are "calved" from these great remaining ice sheets. More than ten thousand icebergs break away from Greenland glaciers every year. Most of the bergs, which move well south in the Atlantic, come from western Greenland. These are not just small floating ice cakes—some of them rise five hundred feet out of the water and are hundreds of feet in length. But even these Greenland giants are dwarfed by bergs, fifty miles long, that have been reported in the Antarctic.

No one knows surely what caused the glacial period, although geologists have advanced several different theories to explain it. When the period was at its height, the great ice sheet reached as far south as the Ohio valley in what is now the United States, and as far south as Bavaria in Europe. Strangely enough, the glaciers did not join to form a continuous and unbroken sheet over the Rocky Mountain area, nor did they affect all of Alaska or Siberia.

Those great glaciers, whose thickness is estimated at from four thousand to ten thousand feet, possessed such tremendous weight and grinding power that they actually remade the face of the country they covered. They moved whole river systems, filled in some lake beds and scooped out others, wore off the surface of mountains and, in many cases, left plains where hills once stood. Material from those lost hills and mountain tops was carried hundreds of miles from the point of origin and then redeposited.

The glaciers imprisoned so much water that sea level in warmer parts of the globe was lowered more

While skaters and ice-boaters skim along the surface of the lake, Sager's ice cutting machine, devised in 1881, saws blocks of ice to be stored in ice houses along the shores of the lake.

PHOTOGRAPH FROM BETTMANN ARCHIVE

Marco Polo, on one of his journeys to Asia, learned the secrets of making milk and water ices and brought the recipes back with him to Italy.

The first ice bowl is recorded in 1621, made by placing one copper cup within another, with water between and a packing of snow and salt.

than two hundred feet, while, because of the resulting cold, the snow line marched down four thousand feet below where it is today.

Weight and pressure of the ice caused the earth's surface to crack and buckle so that, when the glaciers finally melted, the parts of the earth they had covered presented an aspect vastly different from their former appearance.

Suppose the glacial age had never happened. There would be no Great Lakes in this country, at least not the lakes in their present form. The eastern mountains would be higher and more rugged. New England would be less stony, and soil of the middle West might not be so fertile. The Ohio and Missouri rivers would be in considerably different positions, and the entire Mississippi system would be affected.

The age of glaciers had a great effect on living creatures, both plant and animal. As the ice sheets advanced, the plant life changed. The most tender died out first, or were driven southward, and then the more and more hardy, until finally their remains were ground to dust beneath the ice. Then, centuries later, the ice receded and the plants moved northward again in a slow but steady advance to reclaim the land.

Animal life, including man, also retreated before the glaciers, making certain adjustments to the changing environment. Some species, unable to make the necessary changes, died out and were lost completely. Others modified their habits and survived.

In a few cases the great ice sheets swallowed up individuals, freezing and preserving them for ages. Occasionally one of these naturally refrigerated relics has come to light, mammoths being the ones that have been given the most publicity.

These finds are awe-inspiring because of their great age and extraordinary state of preservation, but, thanks to modern science, there is no mystery about them. In bygone days, when one of these animals escaped from its age-old cold storage chamber, it was the source of many legends. Its bones became those of saints and heroes, of super-beings and demigods. They were sold as holy relics or powerful charms to credulous persons who believed the tales told by canny and perhaps only slightly less credulous salesmen of an earlier day.

Since the Egyptians, Assyrians, Babylonians, Phoenicians, Greeks and Romans knew only lands that were warm, or where the snow and ice of winter were sure to give way each year to the warmth of summer, ice played little part in their mythology. But the Norsemen, who knew about ice from everyday experience, thought the whole universe had once been ice, that the first god had been licked from a block of ice by a

Indoor ice makes possible a surface upon which the beautiful and graceful production of skating shows may be presented. There, too, ice hockey may be played and skaters be sure of ice.

PHOTOGRAPH FROM THE ICE-CAPADES

One hot August day in 1774 the proprietor of a Paris coffee house placed before the Duc de Chartres his coat-of-arms moulded in "a frozen milk mixture."

In 1805 Frederick Tudor of Boston started the natural ice trade on a large scale. Shipped from New York to Charleston, S. C., ice was transshipped to the West Indies.

celestial cow, and that the frost giants were the main enemies of gods and men. Eventually, so the northern stories went, the frost giants and their allies would be victorious, and, in the twilight of the gods, the whole world would sink into a chaos of ice and snow, flame and destruction.

But sometime, long before the days of the myth makers, man first realized that ice and cold were not complete enemies. By making use of them, he could preserve part of his scanty food supply, saving it in times when hunting was good for use later.

Nobody kept records in those days. No one knows who kindled the first fire, chipped the first arrowhead, molded the first pot. No one knows who made the first halting discovery of refrigeration. Maybe it was a hunter who noticed that meat stayed fresh longer when stored in the coolest part of his cave. Maybe it was a hunter's wife. At any rate, someone made the discovery, and then refrigeration stood still.

Man changed from a hunter to a herdsman and a farmer. Families developed into clans, clans into tribes, tribes into cities and sometimes into nations. But man continued to use the coolest parts of caves and underground chambers as storage places for preserving his food. Ice came and went. Man used it when he could, but never dreamed of making it artificially.

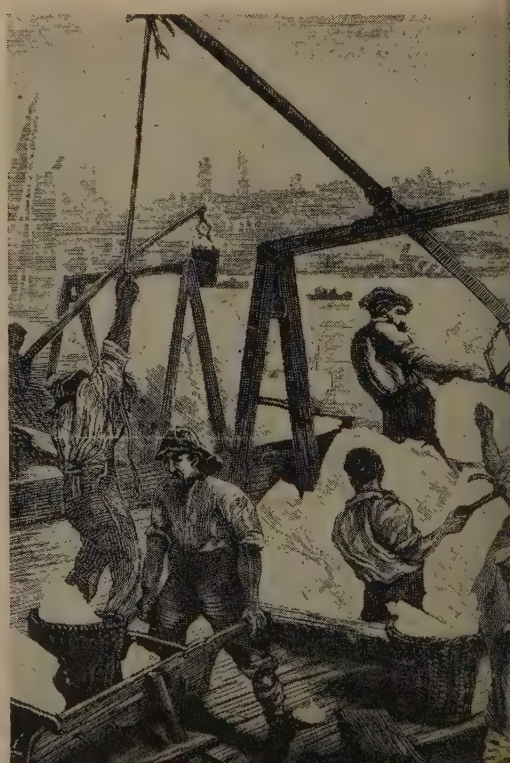
The Egyptians encouraged the formation of natural ice on cool nights by filling shallow clay pans with water. Row after row of these pans were laid out, in plots covering as much as four acres. By morning thin layers of ice could be harvested.

During his campaign in India, Alexander the Great had his wine cooled in great trenches filled with snow and covered with branches. The Romans developed a method of using cold water and saltpeter to cool their wine, and, like the Greeks, they also stored snow in deep underground pits. Nero, whose name is more often linked with fire, is said to have established ice houses in Rome.

Roman emperors also were wealthy and powerful enough to have gangs of slaves bring fresh snow and

The woodcut below, dated 1859, depicts the storing of ice in a New England ice house during a cold spell. The contemporary comment is: "The use of ice as a luxury is just beginning to be known amongst us, and when duly cultivated will make our lakes a mine of treasure." At the right is a picture, dated 1875, showing the unloading of ice in England from ships that have brought it from Norway. Necessity of transportation and handling in this manner made it still a luxury.

PHOTOGRAPHS FROM BETTMANN ARCHIVE



In 1849 John F. Krantz and S. B. Schmidt formed a partnership in a natural ice business, and 50,000 tons were shipped annually by water from Boston to New Orleans docks.

Thomas Masters, in the middle 1800's, gave to Londoners the first container for natural ice. It was called the "Ice Preserver," keeping rough ice to cool beverages and food.

ice from distant mountains every day. By this means, chilled food and drink could be served at royal banquets. The Inca and Aztec rulers of the New World also are said to have used this type of refrigeration.

When the Roman Empire fell, the system of refrigeration by slave power fell also, and later rulers went back to cooling their food in caves or in underground snow pits. But this was not always successful, and people often had to be content with food that was partially spoiled. To disguise this, cooks used all the spices they could, literally burying the rotten taste under a barrage of flavoring. If the world had known more about refrigeration, the craving for spices would not have gripped Europe, and Columbus might never have set out to find a new route to India and the Spice Islands.

There are a few other references to ice and refrigeration in history that might be mentioned. One story tells how Saladin sent a frozen sherbet, made with snow from the eastern mountains, to Richard the Lion-hearted when that famous Crusader was ill with a fever. Two centuries later Marco Polo, that celebrated Italian traveler, brought back from China recipes for making water and milk ices.

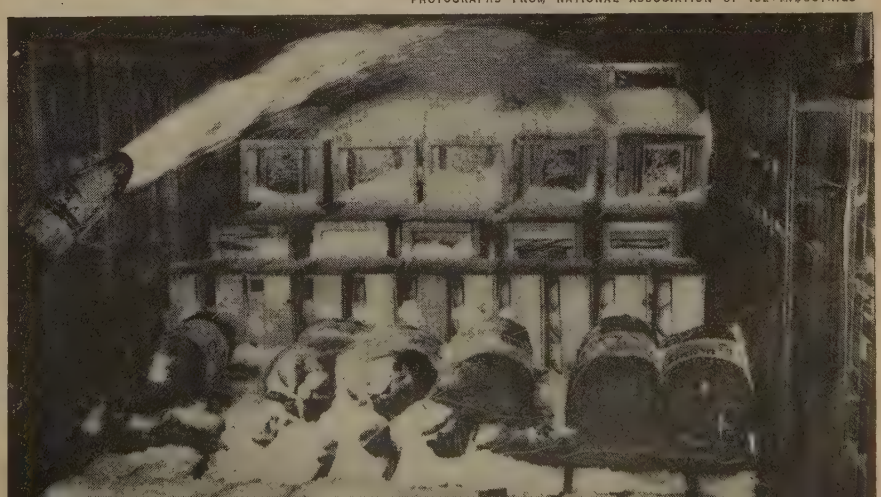
Another three centuries later Francis Bacon, one of the Elizabethan immortals, caught the chill that caused his death while stuffing a fowl with snow in order to see whether the cold would preserve it. One of his last questions was about his experiment.

The seasons marched on. In some localities ice was cut in blocks, packed in straw or sawdust and stored in insulated houses during the winter and sold in the summer. Dealers in ice and snow were fairly common in France by the end of the seventeenth century. Frozen lemonade and other ices were sold on the streets of Paris by a guild of "limonadiers", but, even so, ice refrigeration was a luxury far beyond the means of the majority of people.

The broad stretches of clean water that froze each winter in the New World offered much greater possibilities than those in the Old World. The ice business began in this country at about the time the

In contrast to the pictures on the facing page are such scenes as these here, one of ice being loaded by mechanical means into a refrigerator car to preserve food for shipment long distances to city markets, and, below, products of garden and orchard being placed under a blanket of ice in a refrigerator car. Without the modern techniques of food preservation many products could not be safely brought to market. Both producer and consumer benefit vastly from today's ice age.

PHOTOGRAPHS FROM NATIONAL ASSOCIATION OF ICE INDUSTRIES



Besides the "Ice Preserver" Thomas Masters invented one of the first hand-operated ice cream freezers. However, Dolly Madison is credited with having popularized eating ice cream.

In 1755 Dr. William Cullen, a Scotch physician, worked out the first methods for the purely mechanical manufacture of ice, but many years passed before anything was done about it.

United States was born, and a shipment of ice cut from a pond near Canal Street in New York City went to Charleston, South Carolina, in 1799.

The first big ice storehouse was built in 1805, and the ice business grew rapidly thereafter. Yankee Clippers carried ice to India, to China and to both the East and West Indies. For many years after 1840, Great Britain obtained its ice supply from Wenham Lake through Boston, although the trade was eventually shifted to Norway.

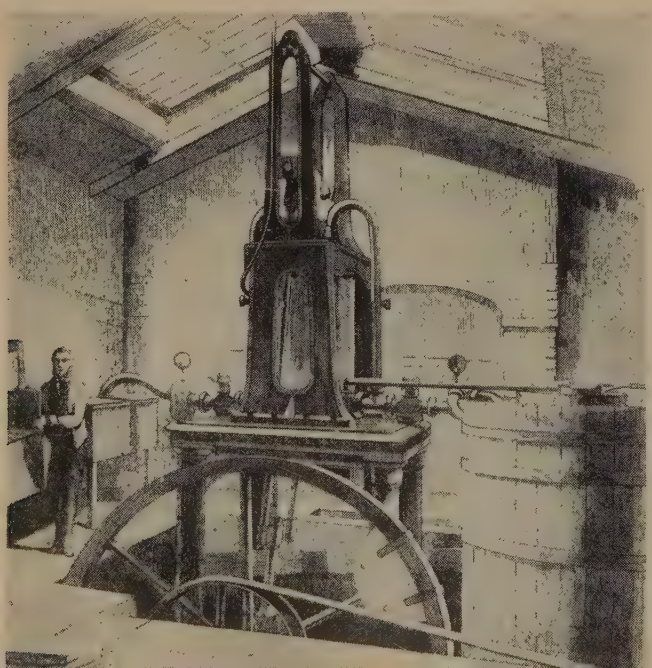
The ice business grew rapidly, and by 1830 ice men made regular rounds in many American cities and towns, delivering ice cut the winter before from nearby lakes, ponds and streams. In the South, ice shipped to New Orleans sold for fifty cents to a dollar a pound, depending on the season. During the War between the States, so great was the desire for ice in the Confederacy that blockade runners braved the guns of Union warships in order to reap the profits resulting from sale of such a cargo. One of the new-fangled ice-making machines also was run through the blockade and later set up in Louisiana.

There are a great many "firsts" in the ice industry, just as there are in any other. The first machine to produce ice by purely mechanical means was invented by Dr. William Cullen, a Scotch physician, in 1755. But, after this first start, many years passed. Several methods for making ice were developed, but the machines proved either too expensive or too impractical for actual large scale production. For a century and a half after man knew how to manufacture ice artificially, he continued to use natural ice for his needs—or to go without.

The first machine capable of making ice in commercial quantities was patented in England in 1834 by Jacob Perkins, an American engineer. The first American patent on an ice-making machine was granted to Dr. John Gorrie of Apalachicola, Florida, in 1851. The latter inventor, a physician, hoped to relieve the sufferings of patients ill with malaria and

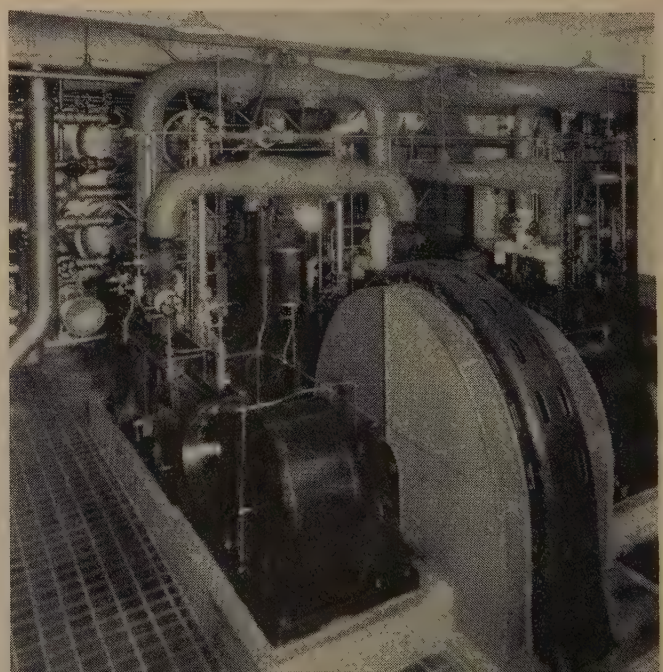
This ice-making machine was invented by Holborn and was thus pictured in 1858. It made slabs of ice eighteen inches square and produced 6000 pounds a day when tested.

PHOTOGRAPH FROM BETTMANN ARCHIVE



Today, sixty-eight hundred modern ice plants like the one pictured below supply the health needs of the American people with fifty million tons of ice every year.

PHOTOGRAPH FROM NATIONAL ASSOCIATION OF ICE INDUSTRIES



Monuments in Apalachicola, Florida, and in the nation's capital, pay tribute to Dr. John Gorrie for his invention, in 1850, of an ice-making machine to cool sick rooms and treat fevers.

After the 1860s, other ice-making machines were developed. The ammonia absorption type, forerunner of the method used today, was devised by an inventive Frenchman, Ferdinand P. E. Carré.

yellow fever. But although Dr. Gorrie discovered how to freeze water, he never learned how to remove the ice blocks from the containers in which they were frozen. He died four years after obtaining his patent, with the problem still unsolved.

After the 1860s, other ice-making machines were developed. The ammonia absorption type machine invented by a Frenchman, Ferdinand P. E. Carré, is considered to be the forerunner of the type used today. But, until shortly before the turn of the century, when an exceptionally mild winter resulted in an ice shortage the following summer, most of the ice used in American homes was natural. Machine-made ice is comparatively recent, while kitchen-sized ice machines have been common for about two decades.

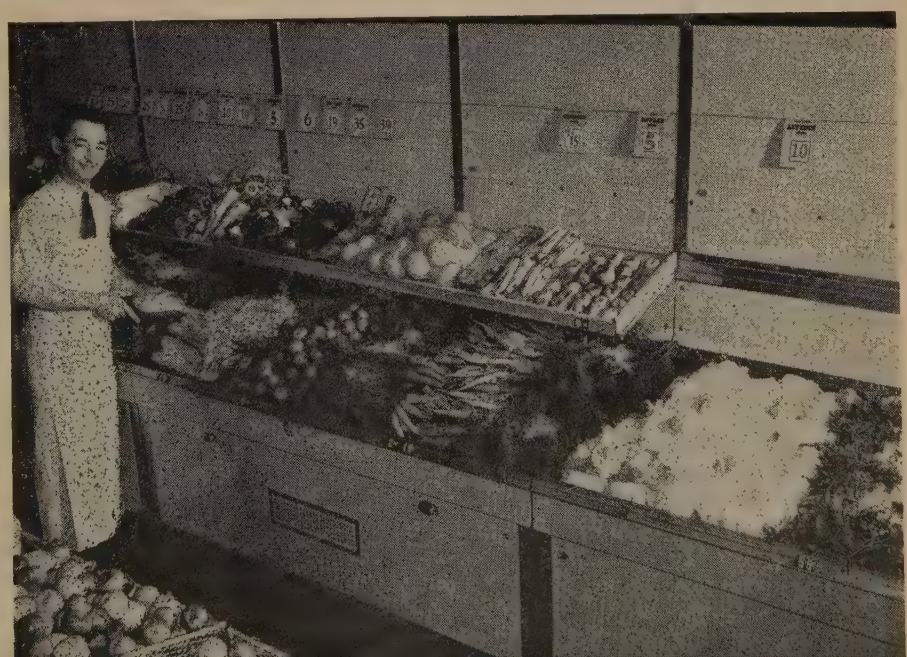
Growth of great cities made the development of artificial refrigeration a necessity. Or, to view the picture from another angle, the development of the modern metropolis would not have been possible without the attendant development of refrigeration.

It is hard to realize just how recent the use of ice is in the shipment of food products. It was only in the latter part of the nineteenth century that ice was used on fishing boats to preserve the catch. It was not until about 1875 that ice was first used on a large scale to preserve fresh meat shipped from America to European markets, while the first fresh meat shipment from Australia to London was made in 1880.

Today there are tens of thousands of refrigerated railroad cars, trucks and ships carrying fruit, vegetables, meat, dairy products and all other kinds of perishables from the producer to market.

Refrigeration is used in a surprising number of modern industries. It plays a part in the air conditioning of public buildings, places of business and private homes. It tickles the palate as ice cream and many kinds of frozen foods. It is used in bakeries and in the powder magazines of battleships. It is employed in the manufacture of chewing gum, chocolate and cigars, in distilleries, in the making of drugs, explosives, film and glue. It is used by florists, by gold miners, by hat makers and by laundries; in printing plants, sausage factories, textile mills and varnish works. An ice box or a refrigerator has become an essential part of every home. Public cold storage warehouses have a place for everything from valuable fur coats to nurserymen's bulbs and plants.

There is scarcely a phase of modern life, be it pleasure or be it business, that is not connected in some way with refrigeration—the modern ice age.



Ice plays an important part in the safe and effective display of produce in stores, keeping vegetables crisp and preventing waste in a time when food means so much to millions.

Red Fox—Resourceful Resource

By PAUL CHURCHER

Illustrated by Frederic Sweney

ONCE UPON a time North America was a fairly nice continent furnished with trees, animals, and Indians. Then the White Man came, cut down the trees, planted the Indians, and harvested the animals. Depending on the point of view, this has been termed culture, civilization, survival of the fittest, greed, and burning the goose that laid the golden egg at both ends.

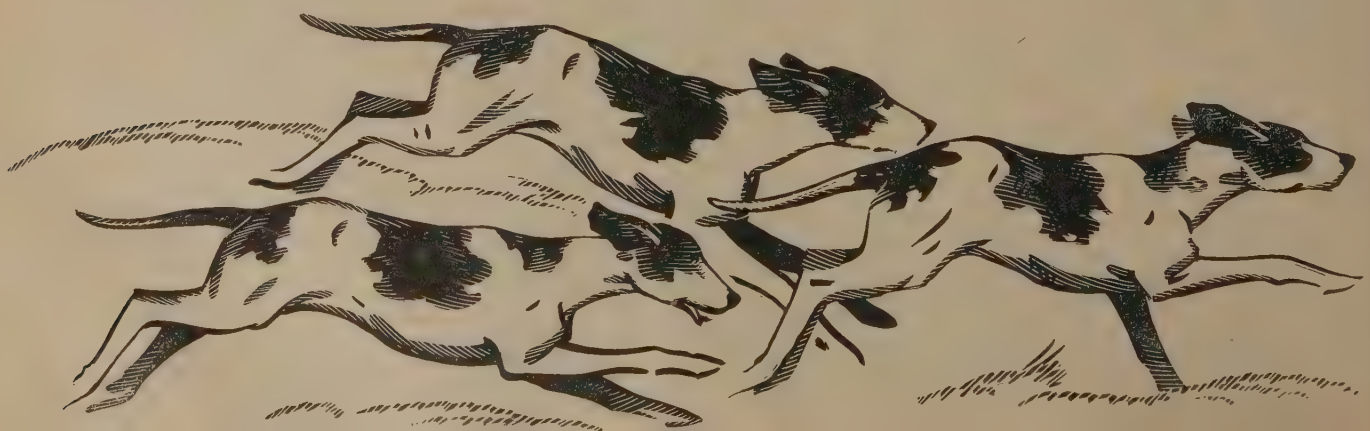
Nevertheless, in hardly any centuries at all, America's liberators stood, masters of everything except themselves, with one foot on the country's Redmen, the other on its trampled flora and its decimated fauna. About this time, in the lee of a grassy hillside, *Vulpes fulva* shifted his goosequill toothpick, hitched up his pelt, and sallied forth to put more sap in *Homo sapiens*.

From then on the red fox has had himself quite a time. Not only has he been one of the few native species to escape being flattened by the juggernaut of progress, but he has even managed to let the air out of that vehicle's tires on a few occasions. As a matter of fact, the chances are that his population has gone up instead of down over the past fifty years. This cannot be proved because Br'er Fox has never sat still long enough to allow a census. But there are few communities he has not cased, or with whose frustrated canines he does not have a flaunting acquaintance. The truth of the latter is borne out by the fact that many foxhound fanciers have sadly wished that they had owned mediocre dogs rather than good ones. The mediocre ones tend to blunder along for a while and come home; the good ones are apt to end up in the next state behind a better fox.

Reynard continues to hold his own despite the handicap of being as conspicuous as a large beagle in red flannel underwear; despite being poisoned, trapped, and hunted afoot, on horseback, with hounds, and from airplanes; despite being tracked down, squeaked up, belled in, and dug out; despite snares, deadfalls, dirt sets, water sets, chaff sets, mystery sets, smoke, gas, and chemicals.

Some of the lures to which he is subjected are enough, in themselves, to put a teetotaler under the third table from the end. In addition to standard musks and castors, elixir of chicken manure, rotten eggs, spoiled butter, asafoetida, limburger, skunk essence, Abyssian civet, "melted" mouse, turtle "tincture," oil of earthworm, whale oil, and lavender water all come *strongly* recommended.

One reason that Mr. Fox gets along so well is that he does not particularly care what he eats as long as it is free. Analyses of stomachs and scats have revealed mammals, birds, reptiles, amphibians, fish, crustaceans, insects, carrion, fruit, leaves, seeds, har-



ness buckles, cigar wrappers, tinfoil, and part of an original edition of *Gulliver's Travels*. Not even a goat with a tapeworm could do better.

Civilization has brought foxes a sort of an epicurean unemployment insurance, too. Wounded game, carcasses left by poachers, carelessly-managed poultry farms, garbage dumps, and untidy picnic grounds provide an endless free-lunch counter; and racing highway traffic specializes in pre-masticated lunches.

The down-hill furrow is another boon that keeps the fox from walking on his heels. Once the shade of dense virgin forests held food and prey to a minimum. Supporting evidence of this is shown by parallel conditions that exist today in remaining wilderness areas. But ultimately settlers cleared the land and plowed their furrows *up* and *down* the hills. When erosion, gurgling happily down these ill-conceived ditches, brought soil depletion, abandoned farms resulted. These stripped and forsaken acres fit the fox as though he were poured into them. Matted pastures with their fence-veins varicose with brush, rheumatic orchards, woodlots senile with shrub and briar, old hilltop fields remembered only by the wind—these are the places where the red fox likes to hang his hat.

However, all this only partially explains why the red fox has contrived to stay out of that color numerically. His personal construction is the pay-off—jet propulsion in fur pants, complete with radar and an automatic pilot. He can out-nose a tabloid columnist, out-listen a housewife on a party-line phone, out-see a sailor on leave, out-climb an aspirant to the social register, out-figure Baby Snooks and out-patience her father.

A pair of foxes can run an ordinary dog to a frazzle without ever shifting out of second gear. One fox could do it, really, but it is not their nature to be selfish. Many a seventy-five-pound dog has earned the right to stop at the first lamppost inside the Pearly Gates because he pursued a ten-pound fox too far out on the thin ice of winter, too near a cliff's glazed edge, or too close to a trap intended for his quarry.

Contrary to clamorous opinion, the fox's economic importance is not so entirely negative that the best that can be said of him is that worse things could be. To trappers he is a capital asset in fur-lined bonds amounting to scores of millions of dollars annually. He takes an enormous toll of numerous and destructive rodents, especially those animated meat factories, mice and rabbits. He is an irreplaceable buffer to the chase in regions where other game species are scarce. He is responsible for the development of the American foxhound. His contribution to the sportsman's menu has given fox hunters appetites second to none. He takes the blame for the sins of less spectacular characters in fur and feathers, and still trots along his buoyant way with tail afloat upon the philosophical current of his wisdom.

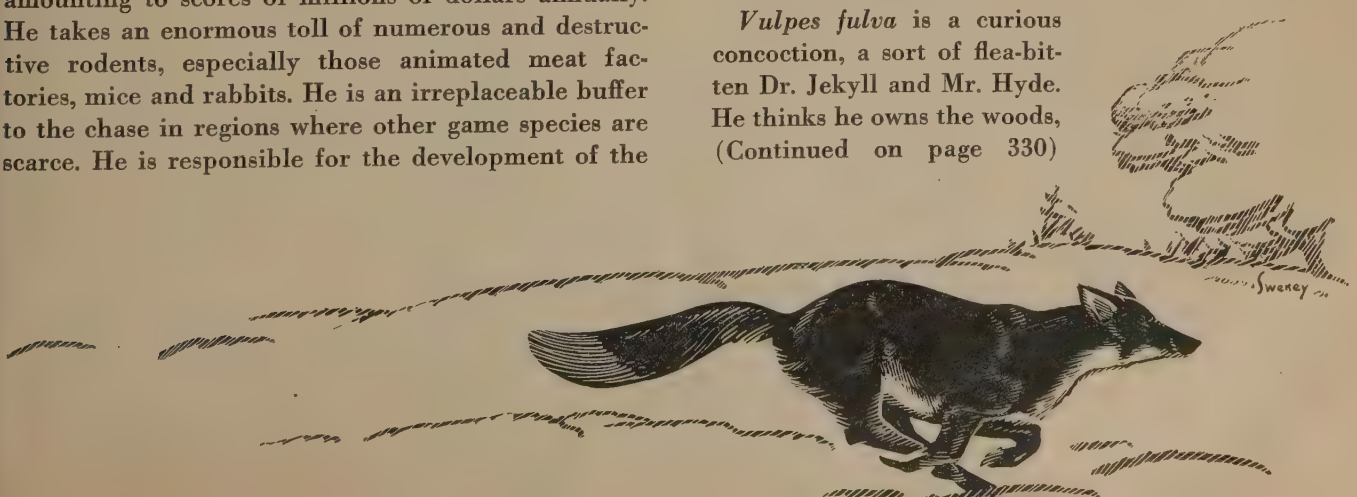
The fox is no third class moron; but neither can he stand up indefinitely to everything that man decides to throw at him. Consistent adverse propaganda, politically-brewed control methods, conservational hocus-pocus, the raucous accusations of the uninformed, can relegate his vulpine majesty to the same dusty museum niche now occupied by the heath hen and the passenger pigeon.

The trouble is, most people know so little about the fox and his place in the overall wildlife picture that they would not recognize one if they met him in a phone booth. They attempt to solve the so-called "fox problem" by extermination drives, by pouring bounties down the drain, and by year-round open seasons. (Twenty states now have no closed season.) It never dawns on them when they grow apoplectic over the feathers of a fox-slain grouse that one pair of these birds would glut a covert with 33,000 epidemic-plagued descendants in less than six years if Nature did not lop off the surplus. Similarly, having been taught since the days of Aesop that R. Fox is President, Secretary, and Treasurer of Cunning, Inc., it is almost impossible to make them believe that this same four-footed genius can sometimes be enticed within gun range by simply squatting behind a haystack and making a noise like a field mouse beating his wife.

Even seasoned outdoorsmen are unaware of many facts of fox lore. They may know that he mates for life; that he sleeps in the open all winter; that he has a bigger bump of curiosity than a two-headed cat in a fish market; that his pelt is prime when the guard hairs are full length, of deepest color, and set in the hide; that he invariably leaves his tracks in a straight line. . . . But they do not know that the tracks are straight because the maker is narrow chested, or that he is built that way to get the maximum of agility. They do not know that the primeness of his pelt is probably due, not to temperature, but to light intensity, specifically to the light received through the eyes, and the light of the previous spring at that.

Vulpes fulva is a curious concoction, a sort of flea-bitten Dr. Jekyll and Mr. Hyde. He thinks he owns the woods,

(Continued on page 330)



Wild Children Obey

By RUTH WHEELER

The parent birds took over the task of feeding the young lark sparrows after they had been placed on a tree limb.

He was only a few hours old, yet he knew how to obey. Because his life would depend on instant obedience, Nature, by the miracle called instinct, had endowed him with this marvelous protection. It would save his life many times.

The baby killdeer pushed out from between his mother's feathers and looked at the vast expanse of the meadow that stretched away in the misty dawn to the edge of the world. Suddenly, he started across the field, amazingly proficient in his ability to run at his first attempt. But his mother called to him in an anxious voice. Instantly, involuntarily, the baby turned and ran to her side. With her bill she reached out and pushed him under her breast, away from the cold wind that would have chilled him to death in a few minutes.

I had been watching the killdeer nest for two weeks, learning something of the habits of these birds. The night before I had discovered that two of the eggs were pipped. I had come back before dawn, stretched on the ground a short distance from the nest, and covered myself with a brown canvas. I knew that when daylight came the birds would not be disturbed by my presence if I did not move. I wanted to see the first hours in the life of a little killdeer.

After an hour or more, another baby pushed out from under the mother's wing and started away. The mother turned her head and called. Again, I saw that quick obedience as the little fellow returned to the protective warmth of the nest at mother's call.

When I arose to leave, the mother cried out in alarm and ran from her nest, but the four little ones remained pressed close to the earth. I returned late in the forenoon and found the nest deserted. A movement in the field caught my eye. The two adult birds were running slowly across the meadow with their heads down to cover up their white breasts and render themselves less conspicuous. Between them ran their young.

The parents flew to meet me, and the baby birds disappeared. The mother sought to attract my attention and lure me away, spreading herself, displaying bright colors, and trailing her wings in the dust. When I did not follow she became desperate, rolling over on her back in her wild contortions. Meanwhile the father flew back over the young birds, cautioning them to keep quiet.

After a few minutes of hunting I found the tiny killdeers crouching on the ground. Their heads were outstretched, concealing every bit of their light breasts and showing only their mottled gray backs. When I picked one up he made no effort to escape, just lay limp in my hand. I tried to stand him on the ground, but his legs buckled under him. He simply would not stand. Even when I let him go he made no attempt to run.

The father watched from a distance. When there appeared an opportunity for the little one to escape, he gave him a quick call signal to run. The baby

jumped up at once and straightened his long legs. The next second he was running at a surprising speed. I caught him again, but he slipped away through my fingers. He had been told to run, and run he *must*.

When the young killdeers were a few days old the mother led them into a freshly-plowed field to feed. She was not with them when I came into the field, but as soon as she saw me she flew close to the young ones and gave them a signal. They each ran, and each found a proper hiding place beside a clod or in a furrow. Their gray backs blended with the color of the soil, and their comical tufts of tail, which they stuck straight up, looked much like bits of dried grass. Their camouflage was perfect. When they were hidden the mother flew down the field trying to make me believe that she was leading her young that way. She sat down and appeared to brood a nest of babies, cuddling them and cooing to them, glancing over her shoulder to be sure I was watching. When I approached she ran a short distance and tried the same trick over.

Occasionally she took a turn around the field on her swift wings and alighted for the shortest moment near the young, before she came back to mislead me again. Humoring her, I followed where she so valiantly led. When I was far enough away she left me and flew back to her little ones. She must have sounded the "All Clear," for through the binoculars I saw the killdeer babies run across the path at the edge of the field and disappear into the weeds.

One evening when the killdeers were more than a week old, I went down to the meadow again, for I was curious to know where the family spent the night. The mother flew up from the center of the field and came to meet me. I started out into the clearing, as I thought the young birds must be close to where she had left the ground. The father joined the mother and both frantically tried to draw me away. By going in the opposite direction from the one in which they were endeavoring to lead me, I soon spied the four little birds safely hiding in a furrow.

I sat down on the ground and put them on my lap. The mother gave a sharp call, and the little ones cuddled quietly down. The mother made no other sound as she began to circle slowly around me. Closer and closer she came until she stopped right by my knee. She stretched her neck and peeked into my lap at her babies, sitting motionless as she had told them to do. The bird tipped her head on one side and looked up at me for a long moment. From deep in her throat came a soft trill. The babies answered in a sweet high treble as they tumbled from my lap and followed their mother.

Every call the mother had made seemed to have been clearly understood and quickly obeyed by the babies. One soft trill was sufficient to make them quiet, another to set them running at top speed.

Baby quails, like young killdeers, can run as soon as they are hatched. They, too, are led by the signals of their ever-watchful parents. There are so many young in a quail family, a dozen to eighteen all the same age, that the parents have a real task keeping the brood all together and out of danger. Quick obedience is necessary above all traits.

When a nest of mountain quail eggs, which we had been watching, was ready to hatch we wanted to photograph the little fellows as they left the nest. In order to be there before they left the nest, never to return, my husband and I went into the woods one morning, almost before it was light enough to see. The mother quail was on the nest, and she sat tight, never moving while Herschel set up the camera. Only her raised crest betrayed her nervous anxiety. When she could stand the strain no longer, she ran a short distance into the woods. At that instant Herschel snapped a picture, and a few seconds later he took another, but before he could open the shutter a third time a wonderful miracle of Nature was happening.

"Quit! Quit!" called the mother quail from the woods, "Quit! Quit!"

When the parent flickers gave the warning signal the young birds froze into a fixed position and retained it for many minutes.

All those new-hatched quails, with the down on their backs scarcely dry, scrambled out of the nest and started after her. The baby quails tumbled over the leaves and fell from the heights of small sticks, but they *went!* When they were nearly to their mother, and a safe distance from us, she gave a second call.

"Craw-kett," she drawled in a soft, plaintive voice. Each little brown elf flattened out where it was, obeying the mother's command with every fiber of its being. We could have stepped on one and it would not have moved. They all blended with the dry grass and the brown leaves until it was almost impossible to find even one. They simply disappeared like magic.

After a short rest period the mother repeated the sharp "Quit" signal, and the babies followed her as she slowly led them to safety. Off through the woods we heard the alternating calls, first the march and then a rest.

This instinctive obedience of the wild creatures is a fascinating study. We obey our parents because we choose to do so, and because we have learned by sad experience that it is wise to profit by the knowledge of our elders. But no experience had taught these babies the necessity of obedience.

Every kind of bird, as far as we have observed, has its own set of signals to the young. Usually these are different chippings of some sort, but once we heard a strange signal given by a lark sparrow, which was neither a call nor a chirp, but was a sound made mechanically. We were photographing a family of these beautiful sparrows in a nest well hidden at the foot of a shrub in a field of grass. We worked carefully, for the young were large enough to leave the nest and we knew that a fright might send them away in a great flurry. The parents were very shy; in fact, we never got more than a fleeting glimpse of them during the time we were near the nest, for they stayed high in a pine at the edge of the field. When we picked up our equipment and started away the mother suddenly flew down near the nest and gave the strange signal. By spreading her tail very wide and fluttering her wings against it, she made a quick clapping sound. At once the babies burst out of the nest and flew into the dry grass.

"That's something new," I exclaimed. "Let's find the babies and see if the mother has any more signals for them."

We began hunting in the yellow grass and weeds. The mother hid in the foliage of the pine again, repeating continuously a soft chirp. It must have been the "Keep still!" call, for not a little bird moved to betray his presence.

Finally we found one and then another of the young birds. When we had them all together we set them on a limb of a scrub oak out in the sunshine. They sat quietly, evidently obeying the oft-repeated signals of their mother. But when we stepped back a few feet and there appeared to be an opportunity for the young to escape, the mother signaled, "Fly for your lives, children!" with the wing-tail clapping.

The baby killdeer is a precocious youngster, but is endowed with an instinct for obedience that often saves its life.

Again we gathered up the birds and set them on the limb. This time the mother signaled "Sit still," while she and the father both brought insects and fed the young. The babies were content as they settled quietly down, one little fellow even dozing as he waited for food. But as soon as we stepped away a short distance, the mother again gave the signal for flight.

Ground-nesting birds have many enemies, and sometimes the young must obey the call for flight while they are still far from able to fly. A family of juncos nested in our yard under a tuft of grass. We often paused as we passed by to look at the tiny birds. The parents were only mildly alarmed at our presence, occasionally chipping a warning to their little ones.

One day our son heard the juncos chipping in wild excitement. As he ran toward the nest he saw a baby bird struggle through the grass; it was too young to fly. He picked up the bird and reached under the tuft of grass to put it back into the nest. His hand touched a coiled snake.

We killed the snake and released from its jaws one of the baby birds, which was completely stupefied. Its feathers were stuck down with slime from the snake's mouth, but it did not seem to be injured in any way. We wiped it clean and held it for a while until it began to show signs of activity. All four of the little birds had survived the danger; so we put them back into the nest, arranging the overhanging grass as it had been be- (Continued on page 330)

The record in the sand shows that a ghost crab sidled into the picture at the upper left, ran forward a short distance with all eight walking legs leaving a clear track, then hurried off again to leave the picture at the lower right.

Sand Spoor

By LORUS J. and MARGERY J. MILNE

FABRE once wrote of the difficulties he experienced in observing animals out-of-doors, because of frequent interruptions by fellow human beings who could not imagine what he was doing. Some such feeling, although unexpressed, led us to rise at dawn and walk along the beach on the ocean side of Cape May. One of us carried a camera, tripod and accessories; the other an assortment of jars into which prized specimens could be placed

(Left) Over yesterday's sharp crested dune a ghost crab's track cut tiny footprints in the dry, packed sand. (Right) Grasshopper trails on the dry beach. The larger prints show where the insect's hind legs pushed against the sand in making a hop.

as found. Together we inspected the beach drift and the band of water where the larger-than-average waves washed flotsam and jetsam back and forth. Every little while we discovered something to add to our collection. Hunting was good at that early hour, and each new trophy elicited much comment and discussion. Soon the one of us with the camera equipment took charge also of the jars, so that the other of us could hold in one cupped hand a large jellyfish (too big for a jar) while the opposite fist clutched the long, sharp tail of a huge horseshoe crab. It is just such specimens that fill museums of natural history!

For long enough we were so intent on our beachcombing that we paid no heed to the animal tracks. Perhaps it was only when our burdens became too numerous for us to make any further additions, that we shifted our attention to the damp sand at our feet. There we were surprised to see indentations of many forms, reminding us of the prints seen in fresh-fallen snow. In winter the woodsman learns to recognize the clean-cut tracks he sees. He interprets trails in terms of vole and fox, bear and bobcat, mouse and grouse. Where they cross or run together, he watches for a rumpled patch of snow, a spot of blood, some fur or feathers for evidence of a tragedy. A stained hollow marks the spot where two hungry animals became one, and that one better fed than it was before.

Neither of us had been conscious before of such marks in sand. What could we learn from the beach? Surely these tracks were sufficiently similar to the types in snow that any observant person could piece them together in terms of the wild inhabitants that shared the region. Probably we had never before been on the beach so early in the day, when the slanting sunlight cast dark shadows even in shallow prints. Certainly first thing in the morning is the best time to study sand spoor. The myriad tracks made during the night are freshest then.

A maze of trails surrounded us. How many of them did we know? What others could we identify? Here was an unexpected interest on the bare beach, and something we could not put in a bottle? Perhaps we could take home a record on photographic film. We scurried around, pursuing our new hobby from waves to dunes and beyond.

Most numerous near high tide mark was a confusion of prints, patterns made by three-toed, webbed feet. From their size and our knowledge of what web-footed birds were common on Cape May shores, it was easy to identify them as the footprints of walking gulls. They overlapped, criss-crossing back and forth where the birds had investigated the sea's edge for food freshly washed up by the surf.

Farther on, a group of gulls stood, beaks to the wind. As we piled our belongings on the beach the better to explore our new problem, the birds raised raucous cries and took to flight. Each squatted for an instant, then leaped into the air as it spread its wings, and flapped away with its fellows. We examined the beach they left, and found gull prints all facing to windward. Here and there the sand had been struck by a pinion tip as the birds rose; a crease marked each spot. Since the tracks overlapped very little, it was obvious that the gulls had scarcely moved while resting on the beach. They must have alighted from the air facing in the same direction. When next we encountered this pattern, its meaning

The sand locust is an active grasshopper, but its coloring blends perfectly with the beach. Only its shadow shows its position. To the left of the insect is a print made by another of its kind a few moments before. The large shadow is the "chest" mark; the others show the positions of legs.

Writings on the beach, in the form of two tracks leading from left to right. Below are the footprints of some beach traveler that ran across the dry sand. Above is the trail of a ghost crab, walking swiftly.

would be clear, and would tell a story all its own.

Another trail led us from the wet beach to the dry dunes. Many marks made by sharp-pointed feet composed the track. It ended in an oval hole near a few blades of grass. Many similar tracks converged to enter this same steep, slanting tunnel. They diverged to become separate trails in various directions. One headed in the direction of the sweet gale bushes beyond the dunes. Another skirted a few clam shells, half buried in the sand, to make a circuit and return to the burrow mouth. In the depths of the tunnel, the trail-maker hid from the heat of day—a pale-gray ghost crab, We could see from its tracks where the crab ran forward instead of sidewise; then all eight footprints could be recognized, as its legs stepped along in sequence. Here the crab stopped and changed direction sharply, only to shift again into a line of march parallel to that in which it started out. Short trails from the burrow opening told of trips the crab made. One started out bravely, but soon stopped, where the animal, without turning around, had raced back sidewise toward the safety of its underground shelter. Other, seemingly similar tracks, ended in little piles of dry sand. They showed where the crab threw earth brought up from its burrow, spreading it at some distance from the opening and drawing less attention to its home.

With a flash of sulphur-yellow wings, a grasshopper flew along the beach and lit nearby. Wings folded, it vanished completely. Its peppered pattern on back and wing covers matched the grains of sand perfectly. Suddenly it took to flight again, leaving a star-shaped mark upon the beach. Once recognized, this too became a tell-tale token of the insect's presence.

But grasshoppers not only fly; they walk and jump, too. Soon we found a track made by a walking grasshopper. The wing tips had trailed and the feet made little marks on each side. All over the beach these faint footprints gave proof of the locusts' progress. Occasionally an insect had become sufficiently energetic to jump ahead. Its hind legs scooped a double crater in the sand as the grasshopper threw its body into the air. It alit on its front and middle feet and its "chest", but again the hind feet formed a pair of pits as the locust leaped once more. When at last it slowed to a walk and stopped its saltatory motion, the four footprints and the "chest" mark showed no corresponding jump prints. Only the trailing wings marked the sand between rows of little pits.

All but the very lightest creatures make their mark in dry sand. Many mark the wet. It takes several grasshoppers to weigh an ounce, yet, once we recognized their spoor, we could spot tracks all over the beach. Such a little accomplishment gave us a new pleasure as we searched the sand. We caught a locust and tried to estimate its weight. The serious consideration gave way to humor as we recalled the statement about Jersey mosquitoes—"many of them weigh a pound." Here we were with a similar proposition, on a Jersey beach.

From the wet sand to the dry beach came a large and labored track marked broadly in the middle, with big footprints on each side. A turtle had left the sea to push her shell-bound body inland. Somewhere in the beach her eggs were laid, supposedly safe in the sun-baked sand, to develop and hatch. Somewhere else her track must have led back to the sea, but her body, lightened of its load of eggs, must cut a less conspicuous trail across the beach. We did not find it, and gave up following the prints we saw when they passed through tangled bushes beyond the dunes.

In the damp sand be- (Continued on page 332)

The crab spider is so marked that, lurking among blossoms of the wild carrot, it is effectively camouflaged. In the picture above the spider has captured a silver crescent butterfly and is dining at leisure on its juices. These spiders do not spin webs in which to catch prey, and walk crab-wise.

Lurking Danger

By GEORGE A. SMITH

A HARMLESS-LOOKING flower may at times contain within its petals a death trap for insects that pause for a sip of refreshing nectar.

The little silver crescent butterfly shown on the wild carrot flower head had been caught and paralyzed by a crafty crab spider. The color of this spider camouflaged it so completely in the center of the flower that it was able to seize the butterfly before it could fly away. The crab spider has caught the butterfly with its powerful front legs, and paralyzed it into helplessness by biting the insect in the neck with poison fangs. While the photograph was being taken, the spider was dining at leisure on butterfly juices. After the body of the butterfly was sucked dry by the spider, it was released and carried away by the wind. The spider was then ready again to conceal itself in the center of the flower, and wait quietly for another meal to appear.

The crab spider belongs to a family of spiders that do not spin webs in which to capture prey. They secure their food entirely by concealing themselves in flowers or leaves, and then lying quietly in wait for their victims. These spiders are generally smaller than a dime. They are white or light yellow in color, with darker markings that help camouflage them. They are recognized by their two front pairs of long and powerful legs. When disturbed these spiders run sidewise like a crab. When they are pulled from their hiding places, they will hang on by spinning a fine line of silk that will glisten brightly in the sunlight.

★

Weathervane

By HARRY ELMORE HURD

A goose is not a hermit bird,
As all men know whose ears have heard

Quanking geese in migrant flight
Across the pasturelands of night,

And yet the goose above our roof
Remains pathetically aloof.

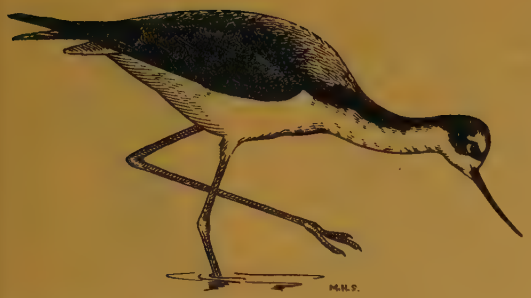
Its sharp wings tilted to the air
Never bear it anywhere

Though weeks ago its feathered kin
Arrowed north with noisy din.

From north to south and back it goes,
Veering with each wind that blows,

A thing bewildered and alone
And senseless as an inert stone

And yet a whirling weathervane
Is alive like snow and rain.



BLACK-NECKED STILT

This is the fortieth in Nature Magazine's series of educational inserts

AVOCET

They Are Shore Birds

By E. LAURENCE PALMER

Illustrated by Hope Sawyer and Clara Garrett

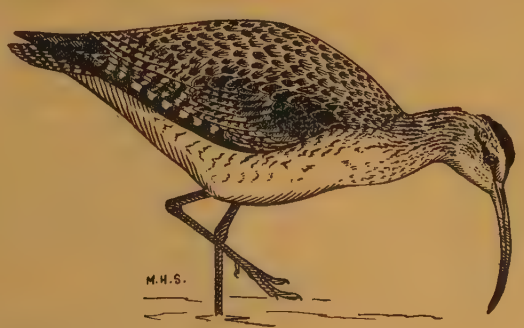
LONG after we have forgotten how Al Smith pronounced "radio", and some of the other idiosyncrasies that endeared him to many and hurt him with others, we will remember his succinct analysis of any situation—"Let's look at the record." There is no better way to begin a consideration of the fate of our shore birds than to look at almost any of their many records. They have made, will make, and should make records of which any group of organisms might well be proud.

The shore birds are masters of flight, of camouflage and of instinct. They are known on the sea, in the air and on the land. They have suffered, are suffering and will suffer, at the hands of man, abuses that might exterminate any less resilient group. In some cases, they have shown an ability to recover once these abuses have been discontinued. They offer at least one tangible reason why international understanding is essential to a happy world, for shore birds are remarkably cosmopolitan in selecting those parts of this world they shall call home. They incite the emotions of poets, artists, hunters, musicians, Nature fakers and literary men and women. In short, they "have what it takes" to hold the interests of naturalists and of laymen alike.

Technically, the shore birds are members of the superfamily Charadrioidea of the Order Charadriiformes. This includes the oyster-catchers, plovers, sandpipers, avocets and phalaropes. In our first draft of this article, we included many birds not members of this technical group but closely identified with what we see on shores. Then we remembered the blistering criticism of some of our best ornithologist friends for what they called sloppy classification followed by some writers. So we decided to include among the shore birds willets that we have seen perched on telephone poles in Utah deserts, and to exclude mallards, which may never have left some of our local shores. Following the logic of our ornithologist friends, we must consider the woodcock and Wilson's snipe as belonging to this group, although we know them best from the wooded hilltops of our home neighborhood. And we must exclude the herons, gulls and terns that make the shores of our local waterways tremendously attractive, particularly during the later summer and fall months.

In the ninth of this series of inserts, we pictured and gave life history data on the woodcock, Wilson's snipe and the yellowlegs, all of which our technical friends will hold should be included here. If they had not been included there, among the game birds and waterfowl, we should have been obliged by space to exclude three from those here presented. So, whether we were technically right or wrong, there may be some gain for our waywardness. But logic is a tool that man uses in strange ways to carve out the destiny he hopes to make for himself. Some of our lawyer friends set themselves up as being the only true logicians. Yet, if our laws were truly logical, it would seem that laws governing shore birds should apply to all shore birds. By this token, the laws that have saved the killdeer and many of the plovers and sandpipers from extermination in the civilized North, where they nearly

WILLET



HUDSONIAN CURLEW

UPLAND PLOVER

vanished, would be applied with equal justice to the golden plovers, the woodcock, the Wilson's snipe and similar birds whose fate is determined by phenomena other than the wisdom of our fellow men.

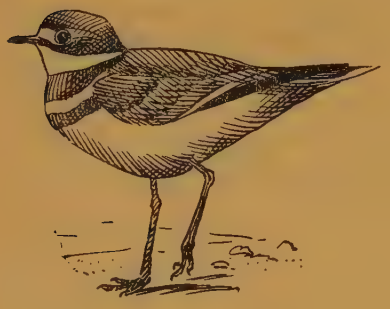
But "let's look at the record" of these shore bird friends of ours. We hope that the shore birds are coming back to the abundance they enjoyed forty or fifty years ago. We have our doubts that they will, because we know our fellow men too well. But, whether they recover to that extent or not, we do hope there will never be a time when young and old alike cannot experience the wild thrill that is expressed in the calls of a flock of yellowlegs. Spring will never be the same for some of us unless we can hear in the distance a group of killdeer, and attempt, by our ears alone, to interpret what is going on in an area we cannot see. Content, warning, alarm, invitation and suspicion all enter the vocabulary of a killdeer for the benefit of those of us who roam the outdoor places to listen. Some of us are ashamed of the part we may have played in learning that vocabulary, as, for example, the sounds produced by a flock of plovers when they swing back to investigate why a wounded companion does not follow.

If it is true that an organism really begins with a gleam in the eyes of the parents, then one finds a shore bird's life interesting from beginning to end. The courtship antics of some of them are no less ridiculous than those of a jitterbugging adolescent human being. Probably, however, such antics serve their purpose, and in neither case do they appear to be ridiculous to the performers.

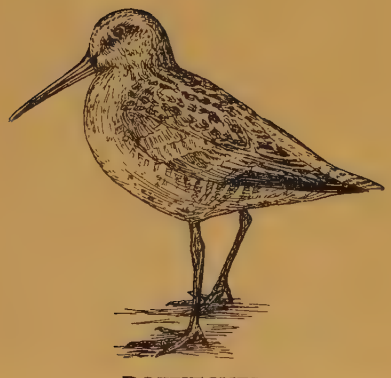
LEAST SANDPIPER

SPOTTED SANDPIPER

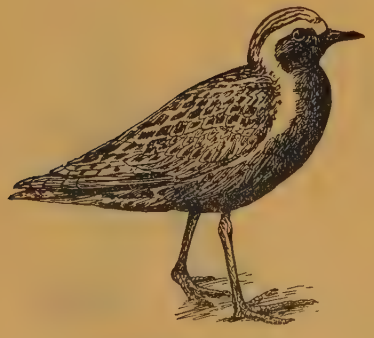
Some species show great effrontery in setting up their housekeeping on an exposed beach and getting away with it. When we witness the antics of some of their human relatives on a swimming beach during a crowded holiday we begin to realize that on a beach almost anything can happen. Housekeeping and beach love-making are a far cry from the atmosphere of remote privacy that evoked the philosophy in Celia Thaxter's delightful verse about "one little sandpiper and I".



KILLDEER



DOWITCHER



GOLDEN PLOVER

If we could conscientiously ascribe to birds the ability to philosophize a little, we would hand a laurel to the shore birds that can rear their young on the ground, in an exposed situation, without going to the trouble of making any nest at all. In contrast, an oriole labors and fusses over an elaborately woven nest, hung apparently out of harm's way, and may have no better success. A nest on a level meadow would only attract attention, so why build a nest? This seems to be the shore bird's philosophy. With them, at least, it works, and no matter what happens they are never likely to face a housing shortage.

When the home has been established and housekeeping is taken up seriously, we find another touch of the modern in the home routine of some of our shore birds. While mother love is highly praised as characteristic of many animal families, and desertion of home responsibilities is a privilege most frequently assumed by the males, we find this reversed quite frequently among the shore birds. With some of the phalaropes, we find the males not only assuming responsibility for brooding and rearing the youngsters, but also assuming less conspicuous attire than that diplayed by their mates. Until recently, it was assumed that the female spotted sandpiper assumed major responsibility for the rearing of the offspring, but prying ornithologists now tell us it is the father who is on the job. It is easy to understand the mistake since the two sexes of spotted sandpiper appear to be identical. The error points to the danger of supposing that a pattern that applies to one organism can be assumed to fit all other related ones.

One of the requirements for graduation from a modern dancing school should be a visit to a breeding place for certain shore birds, such as may be found in the Bear River Bay marshes in Utah. There, in June, one planning to make a profession of dancing could find displayed on all sides a variety of steps, glides and leaps that, properly imitated,

RED-BACKED SANDPIPER

SANDERLING

might lead one to international fame as a teacher of the dance. What the stilts could not improvise, the avocets, willets, killdeers or curlews would be bound to suggest. The sounds that accompany these cavortings should intrigue the writers of the weird in modern music. We venture to suggest that the stilt could give excellent instruction in the *danse baladine;* the killdeer, in the *danse basse;* the willet, in the *danse caracteristique,* while we would feel inclined to turn again to the stilt for our lessons in the *danse haute.* It is hoped that such an experience might induce some of the more bizarre of our modern dancing teachers to invent for themselves a most realistic *danse macabre.* No doubt there are those who will assume that the above is written in a facetious mood. One who doubts that we are serious has never seen a black-necked stilt at its best.

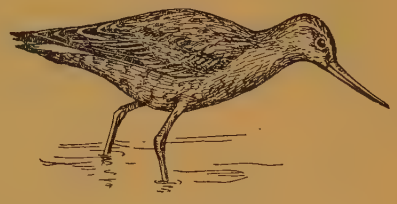
While parent shore birds make much fuss over their youngsters they do not necessarily display great intelligence in their care. A year ago one of my students, Paul Churcher, who has written for *Nature Magazine* quite frequently, found a nest of a killdeer on the gravelled roof that covered the top of a water supply stand-pipe. One might assume that the selection of a site off the ground, and consequently free from many terrestrial marauding enemies, would be an act of intelligence. However, when the young birds hatched they had no food and were unable to pass a surrounding wall. The old birds were unable to solve these problems, and the young died of starvation in what superficially appeared to be an ideal home site for the family.

Shore birds face many hazards in the early days of their existence because most of them lay relatively large eggs, incubate them a relatively long time, and the young emerge able to run about readily almost from the start. If the young birds were as helpless as a young oriole, the shore birds would probably have disappeared from the earth, or changed their nesting habits. The manifest concern of at least one of the parents for the young might well be supplemented by a little more practical assistance. A young killdeer would be benefited much more if his parent gathered food for him, or, at least, showed him how to capture it for himself, than is the case where the parent flies into a tantrum if any strange animal approaches the vicinity of the young. Such behavior may fool some enemies, but it invites even more dangerous ones at the same time.

Since shore birds are for the most part dependent for their food on small animals that live close to the ground, it is only natural that, with the changing seasons, they should seek new feeding grounds. It is unnecessary to review here the details of the migrations presented in the accompanying chart section. It should be noticed that there is great variation, not only in the extent of these movements but in the paths followed. The southern flight of some of the golden plovers is a classic in bird behavior and needs no review here. However, the political implications involved in the fate of birds that spend each summer of their lives far north in one continent and the winters far south in another are such that they are worthy of more thought than they seem to be getting. If man can be directed by law to a sensible behavior towards his environment, then there is an opportunity and a need for legislation that will affect many countries, because most birds know no national borders. What profiteth a shore bird that he gets a new lease on life in North America, thanks to sensible laws and widespread education, if he must spend half of his life in another continent where no protective laws exist, or where those that are on the books get no backing in public practice? Here is a common ground that might lead to a common understanding if only we have the wisdom, the leadership and the will to make it effective.

The story of the terrible punishment taken by some of our shore birds in the Northern Hemisphere when they were considered game birds appears in the chart section. The fact that they have recovered (Continued on page 316)

TURNSTONE



GODWIT

WILSON'S PHALAROPE

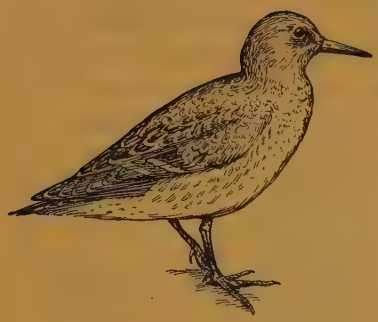
SOLITARY SANDPIPER

COMMON NAME SCIENTIFIC NAME	RUDDY TURNSTONE *Arenaria interpres*	GOLDEN PLOVER *Pluvialis dominica*	KILLDEER PLOVER *Charadrius vociferus*	HUDSONIAN CURLEW *Numenius phaeopus*
DESCRIPTION	Length: about 9 inches, including 2.5-inch tail and .9-inch bill. Wing-spread: to 19.8 inches. Weight: to 4 ounces, with female larger than male. Larger than spotted sandpiper, more compact and low, with orange legs, and in breeding season, with red back and conspicuous black on face and breast. Both sexes have similar color pattern; but female, duller.	Length: to 11 inches, including 3-inch tail and 1-inch bill. Wing-spread: to 23 inches. Weight: to 9 ounces, male and female being about the same size. Appears larger than a killdeer. Lacks the white that shows on wings and tail of black-bellied plover and is golden brown above rather than gray. In spring, shows white line over eye.	Length: 10.5 inches; wing, 6.5 inches; bill, .75 inches. Two black breast bands instead of the one common to other ringed plovers; also, conspicuous reddish spot at base of tail, when in flight. White, on belly, lower breast, throat, before eye and separating neck rings. Back: brown and reddish. Sexes: alike. Body temperature 106°F.	Length: to 18.75 inches; wing-spread, to 33 inches; tail, 4 inches. Hen: larger than the cock. Bill: downward curved; 4 inches long. Long-billed curlew of the West, *Numenius americanus,* is 26 inches long; wing-spread, 40 inches; bill, to 9 inches and has bright cinnamon wing-linings; less gray, than the Hudsonian.
RANGE AND HABITAT	Order Charadriiformes. Family Charadriidae. Breeds: from western and northern Alaska, to western Baffin Bay. Winters: from central California, to Texas, Louisiana and Mississippi and North Carolina, and south, to southern Brazil and central Chile. European turnstone is a subspecies with the ruddy, breeding in Arctic Europe, and wintering from southern Europe to Asia and to south Africa.	Order Charadriiformes. Family Charadriidae. Breeds: from Point Barrow, Alaska, to Baffin Bay and south to Churchill, Manitoba. Winters: on pampas of Brazil, Argentina, Paraguay, Bolivia and Uruguay, migrating nonstop over Atlantic Ocean from Nova Scotia to South America or going down Mississippi Valley, or the Pacific coast. Sometimes found in Greenland, Great Britain or Australia and nonstop Aleutians to Hawaii.	Order Charadriiformes. Family Charadriidae. Breeds: northern British Columbia, northern Alberta, northern Ontario and southern Quebec to southern Lower California, central Mexico, Florida and Bahamas. Winters: southern British Columbia through Colorado, New York and New Jersey south to northern Venezuela, northern Peru and the Greater Antilles. California Pleistocene.	Order Charadriiformes. Family Scolopacidae Hudsonian: breeds from mouth of Yukon in Alaska to northern Manitoba on north. Abundant in spring migration along Atlantic coast from Virginia to Ecuador. Winters: Lower California to Honduras and Chile. Long-billed, breeds Utah to Kansas and Wisconsin; Montana and Saskatchewan; winters, central California to Florida and Guatemala.
REPRODUCTION	Nests: usually on coastal islands, in a hollow, on the ground, with or without plant shelter. Eggs: 3 or 4; 1.7 by 1.2 inches; pear-shaped; grayish green to brown, with dark brown or purplish spots. Nesting period: June-July. Incubation: by both sexes, and but one brood a year. Downy young: blackish gray above, with white forehead strip, black eyeline, and white chin.	Nest: a mere depression, in the earth, with leaf lining, but not carefully made. Eggs: 4 or 5; 2.1 by 1.4 inches; pear-shaped; slightly smaller than those of black-bellied plover. Incubation: for 27 days, by both parents, with but one annual brood. Birds flying across Atlantic are fat when they start, but emaciated at end of trip.	Nests: in open country, on beaches, in plowed fields, and meadows. Nest: simple. Eggs: about 4, buff-white spotted or marked with chocolate chiefly at larger end, 1.5 by 1.1 inches. Incubation: 27 days, with both parents showing great excitement on instrusion. Young able to run soon after hatching. Sometimes, two annual broods.	Nest: a depression or in a grass tussock. Eggs: normally 4, occasionally 5, pear-shaped, variable in color, 2.5 by 1.7 inches. Incubation: probably by both sexes, for 25 days and probably one annual brood. Eggs: of Long-billed, 2.9 by 2 inches and incubation probably about 30 days. Young of both; able to run about soon after hatching.
FOOD HABITS	Food: largely crustaceans, and other marine animals including eggs of many kinds such as the horse-shoe crab. It gorges itself and becomes fat in fall. Call, a repeated "kuk" or a clear whistled, deep, repeated, "quittock." The migration routes are mainly along the coasts and the bird is rarely seen inland in the fresh-water areas, except in spring.	Food: largely insects such as grasshoppers, crickets, cutworms, white grubs, with some berries on occasion. Gives a repeated "coodle" call, and may repeat raising their wings high over the back while on the ground. Stay together in flocks and so are relatively easily decoyed, unless they have been unduly frightened.	Food: largely insects and earthworms or when about water, crustaceans and other forms of water life. Particularly destructive to mosquitoes, flies, grasshoppers, flea-beetles, ticks, army worms, other caterpillars, weevils, wireworms. Superior flier and its calls often notify other birds of danger. Flight speed: 55 m.p.h.	Food: fiddler crabs, spiders, grasshoppers, beetles, crustaceans, either caught on surface or probed for with long bill which can be thrust into mud. Frequents tide flats or flies off shore in formations like geese, the long bill being usually easily seen and serving as identification. Speed: 36 miles an hour.
RELATIONS TO MAN	Protected by the law, it has begun to regain its numbers that were greatly reduced because of heavy hunting. The bird in fall had a fine flavor and was considered a delicacy but this thrill to the palate could not match the thrill to the eye supplied by the living bird in its natural environment.	Economic importance as destroyers of insects should far outweigh their value as game birds, but it is doubtful if this will be recognized, and since the birds are inter-continental their survival depends on their treatment in South America and the Pacific islands as well as in North America. Their long over-sea travel is one of the marvels of bird migration.	Flesh inferior. Protected by law and should have continued protection as it is one of the most useful of farm birds and does little if any harm. Its ways are always interesting, whether it is flying high, dipping on a shore, sitting on its eggs, trying to lead an enemy from its young or feeding in a meadow.	Hudsonian curlew is not good food compared to other curlews. Because of its habitat, it is not so useful in checking pests of agricultural lands. The Long-billed gets greatly excited when its nest is approached and by its calls and behavior gives away its greatest secret. Too useful to be destroyed.

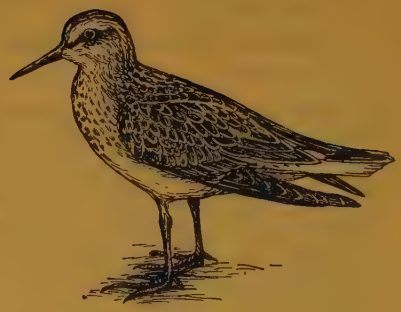
UPLAND PLOVER *Bartramia longicauda*	SPOTTED SANDPIPER *Actitis macularia*	RED-BACKED SANDPIPER *Pelidna alpina*	DOWITCHER *Limnodromus griseus*	SOLITARY SANDPIPER *Tringa solitaria*
Length: to 12.7 inches, including 3.5-inch tail and 1.2-inch bill. Wing-spread: to 23 inches. Weight: to 7 ounces, with the sexes equal in size. A rather uniformly, brown, streaked bird, with long neck, relatively short bill, small head, long tail and the habits of perching on posts like willets, and raising wings in air while on the ground.	Length: to 8 inches; wing-spread, to 14 inches; tail, 2.1 inches. Weight: 2 ounces. Hen: larger than cock. Breast: definitely spotted with large round spots, not streaks, except that young birds and fall adults do not show this character. Outer tail-feathers: white, with black bars. Wing-stroke: short. Has teetering habit.	Length: to 9.25 inches, including 2.3-inch tail and 1.7-inch bill. Wing-spread: to 15.75 inches. Weight: to 3 ounces, the female being larger than the male. In spring, is rusty red above, with a white breast and a black belly. In winter: plain gray above, and grayish across the breast. Bill: long, stout and downward curving at the tip.	Length: to 12.5 inches, including 2.5-inch tail and 2.5-inch bill. Wing-spread: to 20 inches. Weight: to 5 ounces, the female being larger than the male. Related long-billed dowitcher has 3.25-inch bill, the two probably being races. Generally, olive brown but lighter beneath, with white on rump, tail, and lower back unlike the similar Wilson's snipe. Breast in spring: cinnamon.	Length: to 9 inches; wing-spread, to 17 inches; tail, to 1.3 inches; bill, to 1.3 inches. Weight: to 28 ounces. Lacks the white stripe shown on wing of spotted sandpiper. White sides of tail bearing faint dark cross-bars, and conspicuous in flight. The wings appear dark and have a deeper stroke than in the spotted sandpiper.
Order Charadriiformes. Family Scolopacidae. Breeds: from northwestern Alaska, in the northern Yukon area to southern Mackenzie, to southern Quebec and Ontario, and south to Oregon and Virginia and Oklahoma. Winters: on South American pampas from southern Brazil to the Argentine and Chile. Sometimes found in Greenland and western Europe. Should be considered as essentially a rare bird. A bird of fields and pastures.	Order Charadriiformes. Family Scolopacidae. Breeds: from tree-limit in northwest Alaska to northern Ungava Peninsula and Newfoundland, south to southern California, Louisiana and South Carolina. Winters: from southern British Columbia, Louisiana and South Carolina to southern Brazil, central Peru, Bolivia and Argentine. Also Greenland and western Europe.	Order Charadriiformes. Family Scolopacidae. Breeds: northern Siberian coast, and in Arctic America from the mouth of the Yukon to Churchill on Hudson Bay. Winters: from southern British Columbia to New Jersey, and south to southern Lower California, Texas and Florida. Also, found in Asia from China and Japan to the Malay Archipelago.	Order Charadriiformes. Family Scolopacidae. Long-billed: breeds, from mouth of Yukon to western Mackenzie and south to British Columbia. Eastern: breeds, central Alberta and to Churchill on Hudson Bay. Long-billed: winters, Louisiana to California and south to Ecuador. Eastern: winters, Florida and West Indies and to Brazil and Peru. In migration, the eastern outnumbers the long-billed on the West Coast.	Order Charadriiformes. Family Scolopacidae. Two sub-species: the Eastern, and the Western. Breeds: from Alaska to Newfoundland, south to United States northwest border, possibly to Iowa and Pennsylvania. Winters: from Texas and Florida south possibly to Argentina. Appears as a migrant over part of range and between summer and winter ranges.
Nests: in grassy meadows, grain fields or pastures. Nest: on ground, well hidden in vegetation, often under a cover. Eggs: normally 4, rarely 5, 1.9 by 1.4 inches; short, bluntly pear-shaped; larger than those of the similar woodcock's; cream, to olive, to buff, with few, large, gray spots or blotches. Incubation: probably 17 days, chiefly by female, with one annual brood.	Nests: in single pairs, or in small scattered colonies, on ground. Nest: grass-lined or not, in a variety of places. Eggs: 3 to 5, pear-shaped, clay to cream, spotted and blotched with chocolate, 1. by 1.4 inches. Incubation: 15 days, by both sexes but chiefly the cock. One annual brood. Young: run soon after hatching.	Nests: near water, on the ground, usually on a dry knoll surrounded by water; a mere depression, with or without plant lining. Eggs: 4; 1.6 by 1.1 inches; pear-shaped; buff, or gray, or olive marked, blotched, stained or spotted with chocolate or gray. Nesting period: June. Incubation: by both sexes, and probably but one annual brood.	Nest of long-billed: on bare or marshy ground, in moss or depression, unlined. Eggs: 4; 1.8 by 1.2 inches; pear-shaped; clay or gray, with greenish cast, and large, distinct, brownish spots, well crowded at larger end, but scattered over surface. Nesting period: June. Nest of eastern: not known nor is the incubation period.	Uses abandoned tree nest of some other bird such as a grackle, robin or jay. Eggs: 4 to 5, very rarely greenish to reddish brown, with browner spots usually nearer the larger end, the spots forming blotches. 1.4 by 1 inch. Probably, one annual brood. Young birds: gray brown above, and lighter beneath.
Food: largely insects such as weevils, fever ticks, cutworms, white grubs, cotton worms, locusts, grasshoppers, crayfish, and similar essential enemies of farm crops. It may also eat small amounts of grain and seeds of plants. The call is a sweet, melodious whistled "kip-ip-ip-ip," or "quit-it-it-it."	Food: small animal matter chiefly insects including, army worms, grasshoppers, caterpillars, cutworms, cabbage worms, beetles and grubs. Does not flock much even in migration except in South in winter. Can swim and take a dive from full flight and can run under water with help of wings.	Food: probably largely crustaceans and water insects including oyster worms. Red-backed sandpipers appear just before the geese in the fall and after most other shore birds have gone. They feed in mixed flocks with stragglers of other species, run rapidly, fly nervously and appear restless most of the time.	Food: essentially small animals gleaned from habitat, including oyster worms, small molluscs, horse-flies, grasshoppers, leeches, water beetles and the like. Both races feed in moist grassy areas. Both swim well, nodding the head while doing so, but prefer salt water areas more than does the Wilson snipe. Call of eastern: a repeated "tu"; long-billed; single keek.	Food: insects including grasshoppers, waterboatmen, caterpillars, dragon-fly nymphs, spiders, worms, crustaceans, small frogs. Some insects may be caught on the wing by sudden turns in flight. It flies higher than the spotted sandpiper, more swiftly, and in a more zig-zag manner. Usually, tame and unsuspicious.
Essentially useful as a destroyer of enemies of farm crops and formerly considered a game bird, but now so rare that it is worthy of all possible protection. Formerly shot by the hundreds but is now threatened with extinction. Many birds get killed by mowing machines since they nest in pasture grasses. They get no protection whatever in South America.	Entirely useful. Protected by law and worthy of even more protection through the southern part of its range, as it appears to be decreasing. The call is a well-known "peet, peet" or "peet-weet." A white wing-stripe shows in flight though it appears rather broken.	Protected by law, and useful to some extent as destroyers of the enemies of some of our important shellfish. May also help somewhat in destroying a few agricultural pests, though this is probably never important.	These are game birds to those who would kill a beautiful and interesting feathered 5 ounces of flesh in spite of the legal protection it has. They may be useful gleaners of grassy marshes and may help agriculture to some extent, but they are probably essentially neutral except to those who like to see a bird of this sort in the places where it lives.	Useful as destroyer of insects. Too small to have value as game and in a sense too dumb for good sportsmen since when one bird is shot from a flock the others may not move, waiting sometimes until all are picked off one at a time. Fortunately, it is illegal to shoot the birds at all in United States.

COMMON NAME SCIENTIFIC NAME	WILLET *Catoptrophorus semipalmatus*	LEAST SANDPIPER *Erolia minutilla*	HUDSONIAN GODWIT *Limosa haemastica*	SANDERLING *Crocethia alba*
DESCRIPTION	Eastern: length, 16 inches; wing-spread, 29 inches; tail, 3.3 inches; bill, 2.3 inches. Weight: to 10 ounces. Wings, in flight: conspicuously black and white. Tends to stretch wings, showing patches. Legs: bluish. Unlike many shore birds perches on fence or wire. Western: reputedly paler on back, with larger bill, slightly larger.	Length: to 6.7 inches; wing-spread, to 12.1 inches; tail, 2 inches; bill, .9 inches. Hen: larger than the cock. Smallest of the sandpipers, with yellow or greenish black legs and generally a browner color than the Semipalmated Sandpiper. Generally, streaked brown above and white beneath. Lacks webbed feet of semipalmated.	Length: to 16.7 inches, including 3.2-inch tail and 3.5-inch bill. Wingspread: to 28 inches. Weight: to 13 ounces, female being smaller than male. Bill: slightly curved upward, or straight. Tail: with narrow, white band at end, with adjacent broader black band, and base of tail, white. Wings: dark underneath, black near body, and narrow marginal white to rear.	Length: to 8.7 inches, including 1.8-inch tail and 1.2-inch bill. Wingspread: to 16.25 inches. Weight: to 3 ounces, the female being larger than the male. Common name "whitey" helps identify it as a whitish, plump sandpiper. It shows a conspicuous, flashing white stripe on the wings, and while it appears light in the fall, in spring, it is really rusty. Legs and beak: black.
RANGE AND HABITAT	Order Charadriiformes. Family Scolopacidae. Two sub-species; Breeds from east central Oregon to Nova Scotia and south to southern California, Ecuador and Florida. Winters: from northern California to North Carolina and in Brazil, Peru and Ecuador. Accidental, in Europe, British Columbia and southeastern Alaska. Western Willet said to be Atlantic coast migrant in fall.	Order Charadriiformes. Family Scolopacidae. Breeds: from northwestern Alaska to Labrador and south to Yukon valley, Newfoundland and Nova Scotia. Winters: from southern California to Texas and North Carolina and south through the West Indies, Central America, Brazil and central Patagonia. Accidental, in Europe, Greenland and Siberia.	Order Charadriiformes. Family Scolopacidae. Breeds: from lower Anderson River in Mackenzie to Port Clarence, Alaska, and east to Hudson Bay at Churchill and Southampton Island. Winters: Chile, Patagonia, and Falkland Islands migrating mostly east of Great Plains, going down Atlantic coast in autumn, and up Mississippi Valley in spring mostly. Four species of godwits in America extend range west.	Order Charadriiformes. Family Scolopacidae. Breeds: from Arctic islands, Southampton to northern Siberia. Winters: from central California to Virginia, and south to Patagonia, and from the Mediterranean, Burma and Japan to South Africa, and many Pacific islands. Found almost wholly at edge of breakers on sand beaches but less commonly along inland waterway beaches in migration.
REPRODUCTION	Courtship: by pursuit and holding wings erect. Nest: among grasses of sandy or dry spots near water or in pasture swales or in open. Eggs: 4, olive, buff or greenish, 2.8 by 1.5 inches. Incubation: apparently unknown, but young run soon after hatching, though they may be carried by parents between thighs.	Nests: about wet flats or grassy lowlands. Nest: lined with some grass and possibly leaves. Eggs: 4, pear-shaped, drab or pale brown with rich brown markings, 1.1 by .8 inches. Incubation: largely by the cock bird. One brood a year. Young, downy and buff in color when hatched, with pure white chin and throat, with darker on upper parts.	Nests: probably in or near marshes in treeless tundra. Nest: a leaf-lined hollow. Eggs: 2 to 4; 2.2 by 2.1 inches; pear-shaped; dark green or olive, obscurely blotched with brown. Nesting dates: June. Incubation: probably about 24 days, with both sexes taking part. Annual broods: one.	Nests: near water, but sometimes several hundred feet up above sea. Nest: a grass- or leaf-lined hollow. Eggs: 4; 1.5 by 1 inch; pear-shaped; pale brown, with fine dark spots at larger end. Incubation: for 25 days by both sexes. Nesting period: June-July. Young: downy, with central, black line from bill through forehead to top of head; nape, buff, elsewhere, dark buff.
FOOD HABITS	Food: aquatic insects, small molluscs, fish fry, fiddler crabs and some seeds, tender plant parts, roots and on occasion cultivated rice. A strong flier which may hover over a given point, ordinarily shy, but at breeding season, seems bold in attempt to lead intruders away from nest. Speed: 27 miles an hour.	Food: myriads of small forms of animals found along the shore lines, gathered by dashing in and out with the waves, picking up things as they lie exposed and before another wave can come in. Action in flocks made of families or groups of families is worth watching at any time.	Food: insects, particularly of waterways, worms, crustaceans and molluscs; in fact, almost any small animals to be found in the bird's environment. Call: a relatively low "chip" for such a large bird; when frightened, a sandpiper-like chittering. In northern migration, probably flies across Gulf of Mexico in single flight.	Food: largely molluscs, worms, crustaceans, and insects of the beaches, but may eat insects inland and may even eat seeds and small amounts of vegetation, such as moss and algae. In migration, sanderlings go along both coasts and into the interior of the continent to a lesser degree. Call: a short, distinct, "kipp."
RELATIONS TO MAN	Flesh: of a rank flavor and so not ordinarily considered edible; certainly, it cannot be considered a delicacy and so should be left unharmed at least until its numbers can be more restored than is now the case. The Eastern Willet has practically vanished over much of its original range.	Too small to be of any food value to man and is protected by law anyway. Serves as gleaner of the waterway margins and undoubtedly as food for many enemies. May well destroy the larvae of disease-bearing insects that may be found in its habitat.	Was considered game bird but is deserving of every protection. Since it gets no protection in Southern Hemisphere, it needs all it can get in the Northern, particularly as it is here that it breeds. Eventually, an intercontinental protective treaty for such birds may be effected.	Birds are too small to be considered as game by anyone, and too interesting to be killed by anyone with the slightest touch of kindliness. They are always intriguing to leisurely "beach-combers" who marvel at their skill in avoiding being overwhelmed by incoming breakers.

PURPLE SANDPIPER *Arquetella maritima*	PECTORAL SANDPIPER *Pisobia melanotus*	AVOCET *Recurvirostra americana*	BLACK-NECKED STILT *Himantopus mexicanus*	WILSON'S PHALAROPE *Steganopus tricolor*
Length: to 9.5 inches, including 2.6-inch tail and 1.4-inch bill. Wing-spread: to 16 inches. Weight: about 3 ounces, with sexes in general equal, though the bill of female is usually slightly longer than that of male. A dark sandpiper, robust, with white belly, short legs, and with yellow or orange base to the bill. Conspicuous white on dark wing in flight.	Length: to 9.6 inches, including 2.6-inch tail and 1.2-inch bill. Wing-spread: to 18 inches. Weight: to 4 ounces, the male being larger than the female. Larger than the spotted sandpiper, the bird shows a contrasting white belly and streaked brown breast and the four outer tail feathers are shorter than and lighter than those in the middle. Twice the size of the least sandpiper.	Length: to 20 inches; wing-spread, to 38 inches; tail, 4.5 inches; bill, to 4 inches, curved upward; bare legs, to 6.5 inches. Black and white, with a pinkish head and neck, unlike any other bird with which it might be confused. Female: smaller than the male.	Length: 15.5 inches; wing-spread, 30 inches; tail, 3.25 inches; bill, 2.75 inches; bare legs, 8 inches. Female: longer than male, but with shorter legs. Black, above; white, beneath. In light, shows white beneath, long dangling legs and black, uniform wings. Young birds, duller than the adults.	Length: to 10 inches; wing-spread, to 16 inches; tail, to 2.3 inches; bill, to 1.5 inches. Female: larger than male. This "swimming sandpiper" like other phalaropes has front toes lobed and hind toe elevated. In breeding season, a broad, stripe on neck of cinnamon which changes to black. In flight, shows a white rump and is dark winged, but no wing stripe.
Order Charadriiformes. Family Scolopacidae. Breeds: probably from Melville Island, Ellesmere Island, and northern Greenland, to southeren Greenland and southern Baffin Bay; also in Spitzbergen, Iceland, Norway, Russia, Siberia. Winters: in America, from southern Greenland, south to New Jersey, and in Europe to the Baltic States, British Isles and the Mediterranean. A winter seashore bird in New England.	Order Charadriiformes. Family Scolopacidae. Breeds: in the Arctic, from northeastern Siberia to northern Alaska near mouth of Yukon and northeastern Mackenzie and Southampton Island. Winters: in South America, from Peru and Bolivia to northern Chile, Argentina and Patagonia rarely migrating down the Pacific coast but common particularly in the Fall migration through Mississippi valley and along Atlantic.	Order Charadriiformes. Family Recurvirostridae. Breeds: from eastern Washington to southern Manitoba, and south to southern California and Iowa,—formerly to New Jersey. Winters: from central California and southern Texas to Guatemala, with occasional birds in Ontario, British Columbia, New Brunswick and Florida. Rare, east of the Mississippi River.	Order Charadriiformes. Family Recurvirostridae. Breeds: from central Oregon, Utah, Colorado, Nebraska and central Florida south through northern Lower California, Mexico, West Indies, Brazil and Peru. Winters: Lower California to Florida, south through Brazil and Peru. In migration, occasional in North Dakota, Illinois, New Brunswick, Bermuda.	Order Charadriiformes. Family Phalaropodidae. Breeds: from southern British Columbia to northwest Indiana, and south to central Californit, Utah and Colorado. Winters: from central Chile and Patagonia, south to the Falkland Islands. After the breeding season, most phalaropes go to sea in great flocks. There are two other American phalaropes, the Red and the Northern.
Nests: on ground, either among mosses or on bare ground. Nest: a mere depression, lined with grass or leaves. Eggs: 3 or 4; 1.5 by 1.1 inches; pear-shaped; greenish, clay or drab, with conspicuous brown markings of various shades. Nesting period: May and June. Incubation: probably about 20 days by both sexes but chiefly by male. One annual brood.	Nests: on ground that is dry, but near pools; a mere depression, but usually grass-lined. Eggs: 3 to 4; 1.5 by 1.1 inches; pointed pear-shaped; pale green, brown or olive blotched with black or purplish gray. Nesting period: June and July. Male develops throat structure making it possible for him to give a booming note during the courtship period.	Nests: on ground near shallow water, or even in shallow water among plants, with or without any structure. Eggs: 3 or 4, variable in shape and color, olive to light brown with many small brown spots, 2.1 by 1.45 inches. Incubation: 20 or 25 days. Probably, but one brood each year. Young: appear like adult in a year.	Nests: in small colonies or singly; on ground near or in water, among weeds. Eggs: 3 to 4, pear-shaped, clay colored, greenish, slightly glossy and marked with brown, black or gray, 1.8 by 1.2 inches. Incubation: less than 21 days, by both sexes. Young: able to run about almost as soon as hatched. Adult, at 2 years.	Female is the more brilliant, at breeding time, and does the courting. Male makes the nest, incubates eggs and performs many acts ordinarily done by the female. Nest: a collection of vegetation on ground. Eggs: 3 to 4, long pear-shaped, light buff, clay or drab, splashed with brown, 1.2 by .9 inches. There is one yearly brood.
Food: snails and other small, shelled animals, gleaned mainly from among drifts of seaweed and the like. It also feeds on animals gleaned from wave washed rocks. Birds can swim and usually appear in flocks. In New England, appear in September, are most abundant in November and December and have vanished by mid-March.	Food: mostly insects such as grasshoppers, weevils, beetles, cutworms, horse-flies and mosquitoes, and snails and small shell-fish as well as some vegetable matter. Flocks seem to be most common near salt marshes. Birds seem to sit tight when approached, more than do many other shore birds. Migration is in small flocks.	Food: grasshoppers and other insects, fish, molluscs and crustaceans and a variety of other small animal forms available to it in its environment. The performance of avocets about their nests at breeding time is worth going miles to see and their reflection in still water has great beauty to the artist, amateur or otherwise.	Food: grasshoppers, weevils and other destructive insects as well as the hosts of small animals to be found in the habitat of marsh and water plants where the bird lives. Bird is suspicious and noisy except when near nest; then dances a crazy dance, drags leg as though broken and generally creates a disturbance.	Food: insects such as mosquitoes, leaf-beetles, pill bugs, these being more terrestrial than food of most phalaropes. Birds are active, particularly at breeding time, when a female may court and apparently win more than one mate, she of course supplying the eggs for two nests.
Protected by law, but even when it was legal to shoot them, they were not considered as legitimate prey largely because of the strong fishy flavor of their flesh. Why one should wish to kill so small a bird as this for the few ounces of flesh gained is hard to understand. It is probably neutral in its general economic importance.	Useful destroyer of injurious insects. Formerly considered a valuable game bird because of the nature of the flesh but now protected by law at all times as seems to be sensible. The call has been described as a repeated "kriek." Birds are seen in northeastern United States in greatest numbers in August and September.	Perfectly harmless and essentially useful bird. Ordinarily, the habit of eating fish and some other aquatic animals makes the flesh unpalatable even when it is cooked. It is worthy of every protection at all times.	Does no possible harm to agricultural interests and, if living near farm lands, must do considerable good so there is no reason why it should not be entitled to complete and adequate protection throughout its range.	Probably of some value in destroying insects. Too small to be considered as game and too interesting to be destroyed or permitted to be extirpated further in their natural range. A newly hatched Phalarope seems like a good sized bumble bee. It can lose itself in sedges remarkably easily.



PURPLE SANDPIPER



PECTORAL SANDPIPER

(Continued from page 311) at all seems remarkable, but the encouraging thing is that, with this group of birds, man has proved that he can learn a lesson and can behave himself if he wants to do so. The birds that might have vanished from the face of the globe, under practices that existed in your community and in mine a few years ago, have been saved for our enjoyment and for the enjoyment of our children. The days of learning to shoot a gun by practicing on live pigeons, live nighthawks and live killdeers has gone, and there are few who would ask for their return. The old argument that a breast of killdeer was such a delicious morsel that it justified the expense of harvesting it just does not hold water. Possibly the application of that rule to such species as the woodcock is not far distant.

Unfortunately it is not possible for us to educate shore birds so that they might protect themselves. If so we would recommend, as a first lesson, the techniques of open deployment in which the individuals separate and thus avoid mass slaughter. As things now stand, when there is a "flight" of woodcock it is perfectly easy to assume that the species is more abundant than it really is. When there is a congregation of individuals that have been reared over a considerable territory and are moving in concert, there is tremendous danger. Since we cannot teach the birds of their danger, our only hope rests in teaching humans who may have honestly reached invalid conclusions that would appear absurd were the facts more generally known. It is this task that must be assumed by you, and by me, if the shore birds are to survive.

But there are less serious aspects associated with our interests in shore birds. If you have ever tried to stalk them you have had an excellent opportunity to study the reactions of birds. Can you read into what you see them do, or hear them "say," what their next move is likely to be? If not, try it out the next opportunity you have. You can learn to "call your shots" and never kill a bird if you try to predict with a friend what a shore bird will do if *you* do a certain thing.

The Nature fakers find ample opportunity to ascribe human emotions to shore birds, and sometimes the poets fall into the same pitfall when they assume that these birds may have an attitude towards life similar to ours. Both groups do the birds an injustice by the creation of false values, when real values, if recognized, would be as satisfactory. We can have no point of contention with Celia Thaxter and her sandpiper because we know she must have walked a narrow beach with a sandpiper, even as you and I, but does she not carry the community of viewpoint on life a bit too far before she finishes her masterpiece? It is that sort of thing that antagonizes some people, and, while the poem is quoted in elementary school books the world over, it misses the mark in most cases.

But we do not need to sentimentalize over shore birds to appreciate them. Nor need we to evaluate them solely on the basis of their stomach contents. Just meeting them should be enough to justify their continued existence. Of course, there are those who hope for the return of the days when the birds could be considered legitimate living targets. To be sure, the breasts of some of them, properly prepared, are choice morsels under the tongue. But shooting shore birds and eating them takes them out of circulation. Loss of a morsel of such food is much less than the loss we would experience if we could never watch a flock of the birds running along the edge of breaking surf, could never watch their marvelous flight in migration or mating, or could never hear and attempt to interpret their calls under widely varying conditions. All we can ask here is a frank consideration of these birds on their own merits. We are confident that this will guarantee their existence for the satisfaction of all of us for a long, long time.

Suggested Reading

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As We See It

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Sea-lion Persecution

After hearing "representatives of the State's commercial fishermen, as well as sportsmen, as to the huge amount of destruction the sea-lions were causing," the California Division of Fish and Game announces a program of reducing the herds of California and Steller sea-lions of the California coast by one-half. The sportsmen and fishermen contended that these interesting sea mammals are taking fish they want for themselves, and the fishermen claimed that their nets were being torn or destroyed.

This plan of sea-lion persecution is the latest of similar efforts undertaken after hearing only one side of the story. Yet the other side is amply available through factual information on the life and feeding habits of the animals. In fact, the very agency that now sets out to destroy sea-lions on such flimsy and prejudiced evidence published this information—and now chooses to ignore it.

The California sea-lion is the animal that has endeared itself to millions as the "trained seal" of circus, stage and zoo. It and its condemned relative, the Steller sea-lion, are a part of our native wild fauna, occupying their proper place in Nature's scheme. They were long the object of systematic persecution, and by 1909 the California sea-lions had been so seriously reduced that legislation for their protection was passed in response to public demand. Since that time the animals have increased to an estimated total of some 8000 individuals, of both species, resident on islands off California's coast. The majority are found on lighthouse islands, giving the proposed persecution a Federal angle.

Had, however, the California Division of Fish and Game wished to approach this issue impartially, it need only to have gone to its own files. There would be found "The Sea Lions of California" by Paul Bonnot, originally published in *California Fish and Game* for January, 1928. Under the title "Present Economic Status" would be found the following comment:

"The fact that the sea lions eat fish does not seem to me to carry a great amount of weight in contending that they should be destroyed. Their fish diet is not confined to any one species. They eat, indiscriminately, commercially valuable fish and worthless ones. Having such a catholic taste, they destroy quantities of such fish as dogfish and morays, mollusks such as squid and octopii, and crustacea such as deep-water crabs which have little or no commercial value. The dogfish, morays and octopii are predacious and interfere to a greater or lesser extent with commercial fishing, having little commercial value themselves.

"The sea lions may also be holding in check organisms of which we know nothing, which, if allowed to develop unchecked, through the extermination of the sea lions, might be far more destructive to fishing than the sea lions are at present, and a great deal more difficult to deal with.

"The fishing industries are not, at the present time, suffering from the depredations of the sea lions to such an extent that any extensive reduction in their numbers is necessary."

Or the California Division of Fish and Game might consult the studies of sea-lion stomachs made by the late Professor L. L. Dyche. Collecting specimens for a museum exhibit, he carefully studied the stomachs of twenty-one animals. Giant squid and octopus were found exclusively. Although salmon fishermen at that time were attacking the sea-lions on the ground that they were ruining the salmon fishery, not a single fish scale or fish bone was found in any one of these twenty-one sea-lion stomachs. Dyche's report is so convincing that it has been accepted by scientific friends of the sea-lions as settling the food habit question, at least for the time and place.

If the California Division of Fish and Game has any scientific integrity it will not embark on a campaign of destruction on the evidence of commercial and sport fishermen alone. The time has passed when *properly administered* agencies concerned with wildlife act upon the basis of prejudice, misinformation and half-truths. The pages of the history of our wildlife resources are blackened with too many examples of blind and selfish persecution of bird and mammal species. If the sea-lion herds have become too numerous, and if their habits have an economic significance of any real proportions, the facts should be proved. The testimony of fishermen is evidence based upon superficial observation and no knowledge of the whole story; on utter ignorance of the factors involved in maintaining balance in aquatic life. Elimination of the control task that Nature assigned to the sea-lion may well loose destruction from some other source. The California Division of Fish and Game has a responsibility to the people of California, and of the United States, to protect the sea-lion herds, and to accept the offer of the California Academy of Sciences to make a careful study before drastic steps are taken.

Planting for Today and Tomorrow

By ANDREW S. WING
Executive Secretary, National Garden Institute

Photographs from Gottscho-Schleisner

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"Every Yard A Garden" is the slogan of the Men's Garden Clubs of America, and it might well be a national goal.

GARDENING for beauty as well as for food is one of the few fine things to come out of war. And you can go as far as you like in your garden without fear of trespassing on emergency regulations. From the garden you will be harvesting vital foods for your own use, and releasing precious calories and vitamins for use overseas. At the same time you will be creating a more beautiful environment for your own family, and for your friends and neighbors.

It is good that this is true, for there are few necessities that do not cost several times their prewar price. Gardening costs have gone up, too, but if you are willing to hoe your own row you will not have much to worry about. Spend as much as your budget will afford, with the assurance that it is a good investment in better living. Gardening is one hobby where you have an excellent chance of getting your money's worth.

Although Victory Gardens are again a necessity, we should not ignore the landscaping aspect of gardening. "Every Yard A Garden" is the slogan of one group in the Men's Garden Clubs of America. It might well be adopted as a national goal. And if you think that men have not gone in for gardening in a really serious way, take a look around. Every large city has an active men's garden club, and more are being formed. Ladies, look to your laurels! Many men who never wielded a hoe before World War II are now becoming proficient Green Thumbers.

Since there will probably not be many new houses built this year, we can improve the grounds around our old homes. Examine your home as though you were a visitor entering for the first time. Ask yourself some questions:

Does it look inviting? Do the trees frame the house? Is there an air of refinement and privacy about the front yard, or is it just a patch of grass and a cement walk leading to the entrance doorway? Is there a planting of low evergreens or other shrubs around the foundation, to soften the lines of the house and to tie it to the ground? Are there cellar windows or other architectural features that should be hidden? How about a low hedge around the front to protect the lawn and to provide privacy? Would a flower border help?

Imagine what you would do if you were starting from scratch. Perhaps it would be a good idea to dig up those tall evergreens, which will soon be higher than the eaves, and move them to the back yard. If they are ragged and leggy, cut them down and replace them with dwarf junipers, yew or hemlock. Those forsythia and mock orange bushes, now so tall, might be put in a corner of the back yard. Are those maple trees in need of pruning so that their lower branches

will not darken the lawn and discourage grass.

Every house presents a slightly different problem. If the front yard is deep, there will be room for more planting than if the house stands close to the street. The locations of the driveway and garage are other factors to consider, as is the grade of slope of the front yard. Really nothing is sacred about the scheme as is, unless some particularly beautiful specimens cannot be moved.

Last, but not least, is your lawn. Most lawns need good fertilizing and reseeding of bare spots at least once a year. If you are discouraged about weeds and crab grass, fertilizing will help the good grasses. Tarred paper, or an old rug or piece of canvas, will smother out crab grass. And the new weed killers are worth looking into. (More about these in a future issue.) Personally, I like white clover in a lawn. It covers bare spots, attracts bees, and the bacteria on its roots add nitrogen to the soil. Nor is clover so subject to attacks of beetle grubs. But it must have full sun to thrive.

When you have finished with your front yard, take a good look at the back yard. It will usually include three important elements—the view from your living room windows; your outdoor living room or recreation area; your food garden.

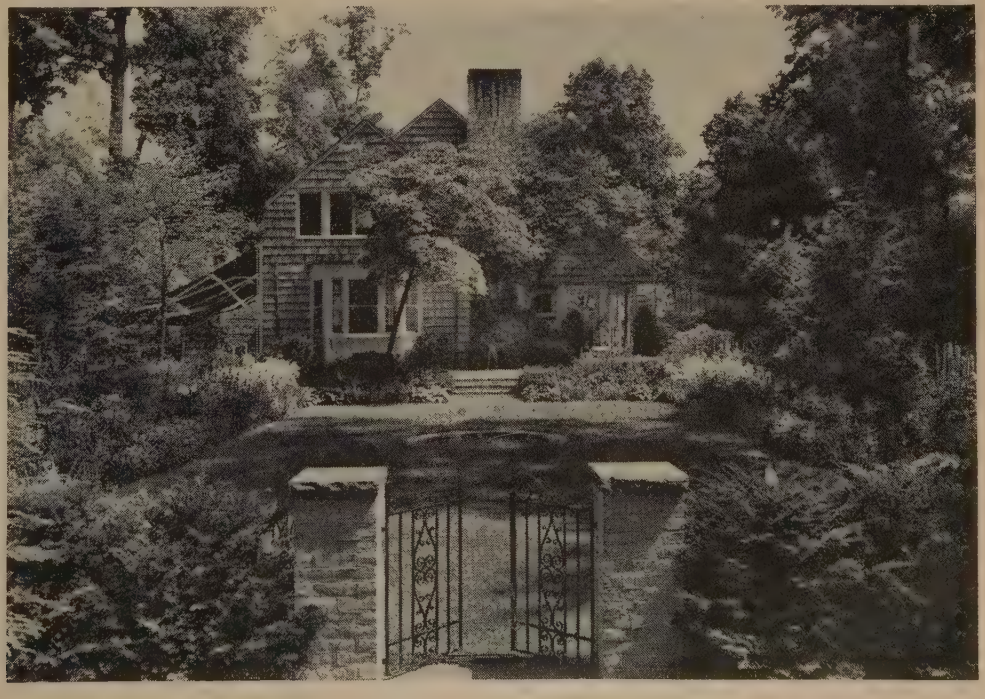
These days the food garden comes first, although it will often be placed at the back of the lot. Screen it in with a hedge or a flower border, if you like, but above all, give it full sun and a fertile, well-drained site. The outdoor living room might be a terrace, or a shady corner, furnished with benches or comfortable outdoor furniture, where meals or cool drinks may be served. A clothes-drying yard can be screened in with tall shrubs so that the family wash does not show from either the house or the garden.

A good book on landscaping will give you good ideas on interesting outdoor arrangements. The back yard can be the very heart and soul of the garden, and the spot the family loves best for six months of the year. Do not neglect the birds—have a bird bath where you can see it from the house or porch, and some bird houses and feeding stations. Some berried shrubs, including barberry, will provide food and protection for winged visitors.

What you see beyond the borders of your own place will naturally shape your plans for lot-line plantings. If your neighbors are close, plant them out, unless, of course, their grounds offer interesting and attractive views. A community of backyard gardens, not set apart but blended together to form long vistas of lawn, trees and flower borders, is a landscaping plan deserving wider attention. Secluded nooks formed by plantings will provide the privacy that every family desires.

Fruit trees deserve a place in every well-planned garden, large or small. Even if grown primarily for beauty, in these days of scarcity and high prices for tree or bush fruits it is satisfying to be able to step out into the yard and harvest tree-ripe, juicy, and delicious fruits. A few fruit trees, grape vines, and some brambles, bush fruits or strawberries can be squeezed into even a small garden. Pruning and spraying are not serious chores, and some gardeners get good fruit with one or two sprayings and an annual pruning. Two or three plants of rhubarb, well supplied with plant food, will supply enough of juicy "pie plant" for the average family.

For those rare families who will buy or build a new home, a real gardening treat is in store. Unless the grounds are already planted, it is fun to start from scratch. If time and inclination permit, draw the plans yourself, using the scale paper that you can buy at any stationery store. The advice of a professional



The back or side yard can be the very heart and soul of the garden, and the spot that the family loves best for six months of the year.

landscape architect may be advisable, particularly if your grounds are large, or if there are special problems. Some of the better nurseries employ graduate landscape men, and often their advice will actually save you money and give better final results.

It is important to remember that no landscape plan needs to be completed in one year. It can be budgeted over a period of years, and, if you have a good plan, the results will be better than trying to complete a sketchy plan in one year's time. Remember, too, that good stock pays. Poor varieties and poorly-grown and ill-packed nursery stock will usually grow into more headaches than anything else. Small but well-rooted specimens, on the other hand, are cheaper to buy, easier to move, and, in a few years, will grow into handsome shrubs and trees. This is particularly true of some of the finer evergreens and other woody plants that are slow growers and necessarily high priced in these times.

The view from the living room window is one of the factors to be considered in planning the yard and garden.

Community and highway beautification is much in the limelight these days. We hear of such ambitious plans as state-wide memorial drives planted to dogwood or other flowering trees. The days of the unprotected and unplanted express highway are numbered, we hope. With a protective strip left in its natural state, or landscaped with native trees and shrubs, as in Westchester County, New York, and Fairfield County, Connecticut, driving becomes a joy indeed. We must have more of these beautiful highways, planned along state and national lines, if our future travel is to come up to the ideals we are coming to expect of it.

Beautifully-built and planted highways are not good enough, however, if, when we are leaving them, we find ourselves at once in the midst of dingy industrial or shabby residential districts. Or, when we ride the handsome, streamlined trains of the future, are we to put up with the kind of industrial and commercial ugliness and squalor that we now find along the main lines of so many of our great railroads? Concerted efforts must be made if we are to offer visitors the kind of scenery that one can see from trains traveling through the countrysides of England or France. Local groups can do much to improve the immediate surroundings around railroad stations, particularly in towns and in suburbs, where there is usually ample space around the stations to allow for attractive plantings. Even where the railroad is unable, or unwilling, to assume the expense of such improvements, garden clubs or other civic improvement associations can often finance the basic improvements, after which the railroad will usually be willing to assume all or part of the upkeep, labor and expense.

At least that is the way it worked out in the little suburban town of Riverside, Connecticut, where I have made my home for many years. The Riverside Association and Riverside Garden Club put up around $50 for plant material the first season and hired the planting done. A small appropriation was made every year—the New Haven Railroad then being financially embarrassed—for upkeep, including pruning, fertilization, and new plants that were added from time to time. In the ten years since this planting was first started, our little station, which had been an eyesore in an otherwise beautiful suburb, has blossomed into a really well-landscaped spot. In the spring there are great banks of giant, golden forsythia. Climbing roses clamber over guard rails. Yews, hemlocks and other evergreens are there in abundance for commuters and the birds to enjoy the year around. There are thousands of railroad stations waiting in dismal squalor for similar transformations.

At the National Garden Conference, held recently in Washington, the delegates present went on record in favor of long-range plans for home and community landscape beautification. Within a stone's throw of the Department of Agriculture stood a handsome and fairly new school building. My companion and I noted with sadness that the school building and grounds, which must have cost taxpayers at least a half-million dollars, were utterly devoid of any attempt at planting.

Now is the time, when we are about to enter a great post-war period of construction of homes and public buildings, to take real steps toward the creation of a new and more beautiful America. Streamlined kitchens, bathrooms, automobiles and trains are not good enough to satisfy the soul of man. Certainly they can never take the place of outdoor beauty. We can make America a better place to live in if we insist that our dollars are spent wisely in the next decade or so. I do not care to live to see the alternative to such a plan.

"The Old Man of the Sea" is a dried head of a fish of the sea-bream family. It came from Capetown, South Africa, and was the subject of an article by Dr. R. C. Osburn, whose artist "dressed up" the face with plug hat, cigar and monocle. The result is a stern and far from prepossessing individual. Publication of these pictures sent Dr. Gudger on a hunt for other examples of fish heads that bear a similarity to human countenances.

Unusual Finny Heads and Faces

By E. W. GUDGER

THERE is no reason why the heads and faces of fishes should look like those of human beings. Fishes are away down at the roots of the vertebrate tree, and man is up in its topmost branches. But sometimes these "unnatural resemblances" do occur, and, to me, unusualities in Nature are fascinating, especially if they send one exploring to find others.

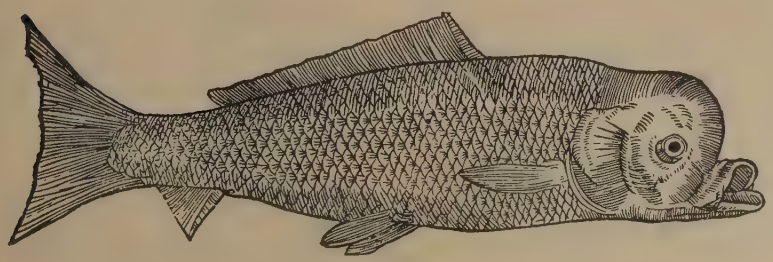
While assistant director of the New York Aquarium, Dr. R. C. Osburn wrote an article for the *Bulletin of the New York Zoological Society* entitled "The Old Man of the Sea." With it were published the two pictures at the top of this page, as startling examples of unusual resemblances as one could ask. This sent me delving back into old natural history books and works on fishes, from which I dredged up a strange collection.

Some of these pictures from the past put a little strain on the reader's imagination; others are startling. All are based upon real specimens in Nature, however much the artist may have taken liberties in the case of drawings.

Dr. Osburn's sea-bream, both in its undressed and dressed version, is the most recent, and perhaps the most startling, of these strange resemblances. It is a dried head, but it has not been manipulated to get a desired effect. Particularly interesting are the large, strong teeth, conical in the front of the upper jaw and elsewhere molar-like. They are plainly intended for crushing the shells of mollusks. Osburn notes that, like the famous King of the Cannibal Islands, the fish "has two rows of teeth in his lower jaw", such as the aforesaid king "needed in his business." These, however, do not show in the photograph.

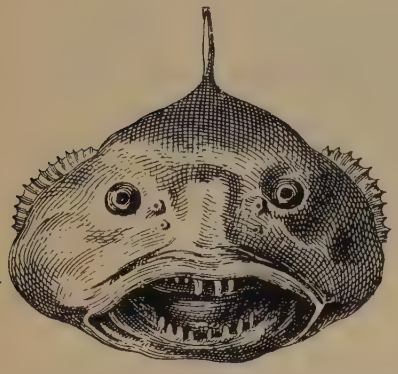
To go far back from this recent finny face, in a search for similar cases, we discover that one Guillaume Rondelet started the ball rolling in 1555 with a drawing of a pug-headed carp. His drawing took a few liberties with fact, however, and it remained for Conrad Gesner, or his artist, three years later, really to give human appearance to a carp. This picture shows this carp in "a how do you do?" pose, head turned toward the observer as though it were moved on a neck. The face has staring eyes, a bulbous nose, distended cheeks, a small mouth and chin and a pectoral fin functioning as a right ear. It is altogether ludicrous.

Between Gesner and Peter Pallas, who published a



Delving back into fish history, this picture of a pug-headed fish—a carp—was found in a book on fishes by Guillaume Rondelet published in 1555. Resemblance to the head of a man is rather remote, but it is included because it seems to have led to the earliest drawing in which a human face is given to a fish. However, the bulging and overhanging forehead, the staring eye, the remnant of an almost non-existent nose and the much-distorted mouth do not place too much of a strain on the imagination.

Conrad Gesner was a great ichthyologist and a contemporary of Rondelet. In his encyclopedic *Historia Animalium*, published in 1558, Gesner refers to Rondelet, and his artist, it appears, must have gotten some inspiration from Rondelet's carp drawing. Gesner had two specimens of pug-headed carps and descriptions of two others. For the illustration he, or his artist, seems to have chosen one that had an abnormality called roundhead, in which the head is abruptly rounded off in front and both jaws are reduced to mere remnants. It is possible to imagine the artist enjoying giving the carp a quite human appearance.



In this front view of the head of a lumpfish, *Cyclopterus dentex*, one can see a caricature of a Japanese soldier. This appeared in a zoology by Peter Pallas in 1769. The human aspect is pronounced, thanks to the staring eyes, open mouth and snaggled teeth. The dorsal fin makes a spike atop a close-fitting helmet and the swollen cheeks nearly hide the epaulets framed by the fish's pectoral fins.

Johannes Schmidt was an outstanding student of the millstone fishes, or ocean sunfishes, of the family Molidae. In the illustration above one of these is shown. It is copied from a pen sketch in J. R. Norman's *History of Fishes*, and that sketch was taken from one of Schmidt's photographs. The fish is a tiny *Masturus lanceolatus*, looking much like a dandified French guardsman equipped with a fine set of "Lord Dundreary" whiskers. The tips of the pectoral fins suggest ears that set off the large, staring eyes.

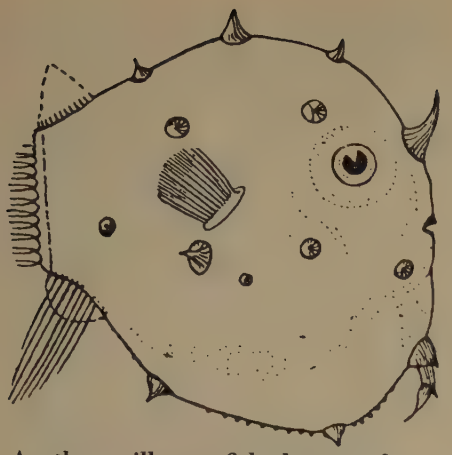
zoology in 1769, there seems to be a lapse of more than two hundred years, so far as these unnatural resemblances go. Pallas made up for lost time, however, with a front view of the head of a lumpfish that is a most effective caricature of an accoutered Japanese soldier.

One of the prolific sources of these strange resemblances is found with the young of the millstone fishes, or ocean sunfishes. The adults of these members of the family Molidae are tremendously compressed laterally, greatly produced dorsoventrally, and are almost round, hence the generic name of *Mola*—a millstone. The young, however, especially when seen head on or in profile, often show a resemblance to the human face. Sometimes the similarity is startling. The late Johannes Schmidt was an outstanding student of these fishes, and a number of his published pictures, as well as drawings made from them, belong in any collection of these finny faces.

One of these suggests a dandified French guardsman, another a long and narrow-faced soldier sporting a short-spiked helmet. Another *Mola rotunda* was pictured and described in 1828 by S. L. Mitchill, whose artist certainly took liberties. The result is the profile of a gentleman with a mild eye, a perfectly good human nose, a firmly-closed mouth and a couple of chins. The head is covered with pickaninny-like spines or horns. The picture may be a work of art, but it is an "unnatural" baby sunfish.

Melancholia appears to prevail among restorations of fossil fishes from Devonian times made by the distinguished German paleichthyologist, Otto Jaekel, in 1906. We assume that it had no international political significance, but one looks much like a lantern-jawed Englishman. This resemblance includes a fore-shortened head surmounted by a small pointed-domed helmet, huge eyes with heavy jutting eyebrow domes, an insignificant nose. The curious mouth has its corners pulled down, and

This round-bodied Mola, *Mola rotunda*, is another of Schmidt's photographs of a little specimen in the Paris museum. It looks like a spike-helmeted soldier with a long and narrow face, while the paired spine-scars marvelously resemble eyes, and the single spine an insignificant nose, thick-lipped mouth. The artist took liberties in doing the profile of the *Mola rotunda*, below, a gentleman with mild eye.



Another millstone fish, but not from Schmidt, is shown in lateral view. The pectoral fin suggests an ear back of the large, staring eye. It does not take too much imagination to see in the backwardly-hooked spine a most retrousse nose. Perhaps a little more imagination is required to see a goatee in the curious, segmented, backwardly-pointing spine on the rounded chin.

there is a cleft upper lip that is a decided "hare-lip." The final touch of the long, drooping "Lord Dundrearies" on either side of the large and long-pointed chin rounds out a total effect entitling this restoration to be called A Melancholic Englishman.

The other interesting restoration is a Germanic nightmare, a sort of medieval robber baron of the Rhine. The fish seems to wear a helmet several sizes too large for him, which, if it does not rest on his shoulders, certainly hangs heavily on top of his head. This figure might be labelled "A Dejected Nazi," and it seems to be thinking of its sins.

Anger and malice fairly ooze from the angry swordfish, which provides an outstanding unnatural resemblance. Of course, no swordfish ever looked like this one, but the angry and determined eye, the implacable mouth, the advanced sword, the battered dorsal fin, with each ray-supported fragment erect like "the quills on the fretted porcupine," provide a total effect expressive of a swordfish boiling with rage.

Turning from anger to joviality, one comes upon perhaps the high spot in the collection of finny unusualities. This looks to be the head and face of a stout individual so full of life and the joy of living as to be ready to go into a dance. The jolly, round face is surmounted by a close-fitting conical cap with three feathers

This picture, and the one at the left, both restorations of fossil fishes of Devonian times, suggest gentlemen in states of profound dejection, amounting to melancholia. One is a lantern-jawed Englishman, and the one above is a Germanic nightmare, with its round head, huge eyes, steel-trap jaw, and side whiskers protruding on each side of the jaws of a chinless face.

No swordfish ever looked like this angry fellow pictured in *Animal Ingenuity of Today* by C. A. Ealand, but in taking artistic license the artist has produced an excellent character drawing and the most "unnatural resemblance" of all those here gathered. The swordfish certainly looks like an angry old gentleman with a flashing eye.

To end on a jovial note, one need not look farther than this resplendent fish pictured in *Naturalist's Repository* by E. Donovan. This purports to be "Tobin's Striped Trunk Fish," named for a Captain Tobin, who is supposed to have taken the specimen off Van Dieman's Land, and made, or had made, this fancy drawing of the fish.

right and left of the brim. It has three black bands around it, a curlicue on top and, behind, two bird wings formed by the dorsal fins. Surely no Tyrolean cap ever equalled this one. The picture is rounded out by the sharp and knowing eyes, the long straight nose, the small mouth, the flat, cross-striped full cheeks, the lovely pectoral fin ears and the keel-like chin.

This fantasy purports to be "Tobin's Striped Trunk Fish," so named for a Captain Tobin, who took the specimen off Van Dieman's Land. E. Donovan published it in his *Naturalist's Repository* in 1824. In so doing he remarked "that a more singular being than this curious fish can scarcely be conceived, or one more fancifully grotesque when viewed directly in front. . . ." This seems to set a high mark in the field of understatement.

One may well wonder how accurate these figures are; how truly they represent the heads and faces of men. The photographs, of course, speak for themselves. The resemblances in them, while accidental, are real. When one studies the drawings one must make reservations. Gesner's anthropomorphic carp is what the artist thought he saw, or what he wanted to see. Pallas' caricature of a Japanese soldier probably has a sound origin in the structure of the head of the fish. (Continued on page 330)

Snakes of Okinawa

By RALPH J. DONAHUE

DURING the final preparations to invade Okinawa, late in March, 1945, men of the armed services of the United States were "briefed" against the perils that might be expected in addition to the defending Japs themselves. Foremost among the dangers mentioned were malarial mosquitoes and poisonous snakes, both of which, fortunately, proved to be far less of a hazard than expected.

Nevertheless, there were Okinawan snakes that could, and did, do damage to the troops in the field. But, although some dozen were bitten, not one proved a fatality. This good luck may have been due to the prompt first aid that was always at hand.

The most dangerous snake on the island is the habu, *Trimeresurus flavoviridis*, dangerous both because of its favorite place of rest and the potency of its venom. This reptile seems to like to climb trees, and to lie along branches as though in repose. From this position it may strike, with effect, any who may be luckless enough to brush against it. According to native reports, men bitten about the face by this reptile have died within an hour.

However, in all my rambles about the island, after it was secured, of course, seeking specimens of natural history for the U. S. National Museum, I saw only two specimens of habu, one of which I helped kill, and one that had been killed a few hours previously. The first specimen was found on the ground of a scrub pine woods, and measured thirty inches in length. Its general appearance was dusty- or grayish-brown, with a belly of light gray. Down its back ran a double row of small diamond-shaped markings, enclosing in each a circular "eye" of gray. The diamond markings, while in rows from head to tail, yet were staggered in such a manner that the point of one fitted into, but did not touch, two others opposite it. The head, large in proportion to the slender body, seemed even more "out of balance" because of an extremely small neck. The head was one and one-half inches across by two inches in length, and was armed by a pair of fangs that compared with those of giant rattlesnakes of the Texas plains.

Next in point of venom and number of individuals found was the mamushi, *Agkistrodon halys blomhooffi*, several of which came to my attention in the course of my trips over the country. One I collected and preserved for the museum in captured Jap formaldehyde. This reptile was twenty and one-half inches long.

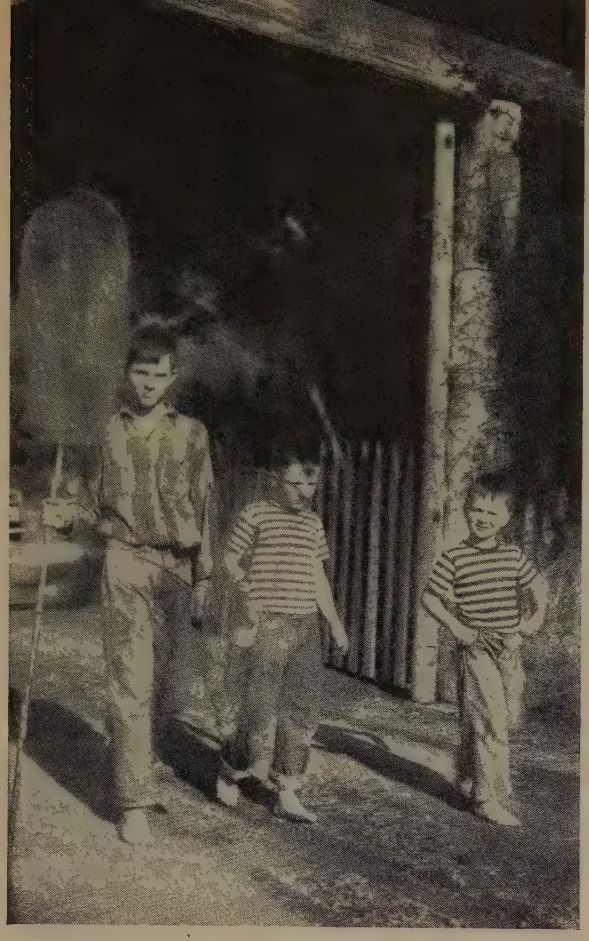
In July, a native woman, working barefooted, as

PHOTOGRAPH BY W. E. SALMON

The author inspects one of the snakes of Okinawa, a mamushi, which was collected for the United States National Museum in Washington, D. C. This specimen, when opened, was found to be a female whose body contained five embryos.

is the custom, and cutting underbrush within the camp area, was bitten on the lower leg by a mamushi. Since, to the natives, all snakes are "habus", she immediately began to scream "Habu! Habu!" Because it was only a few hundred yards to the first-aid station, the woman's life was saved, and a few days later she was back at work with her machete.

There is a third common poisonous snake on Okinawa. It is a small species, kindred, I am told, to the coral snakes. These reptiles varied in length from eight inches to as much as eighteen. The head is small, the fangs minute, and poison sack even comparatively smaller. The snakes are black on the back with narrow twin stripes of orange running from head to tail tip. A cream-colored stripe parallels the orange ones some distance down the body walls. The underside is cream with brownish patches of irregular design, separated from each other by dark lines dividing the belly length. The black back, striped with orange and yellow, is further decorated by black and yellow rings, evenly spaced, but variable with the individual from eleven to thirteen. The number, apparently, has nothing to do with length body or age of snake. The tail bears a short, sharp horn of black.



Alex, Mouse and Robbie leave the ranch on a hunt for butterflies.

Butterfly Summer

By HULDA MacLEAN

THE SHARP buzz of a rattlesnake startled Alex into dropping his butterfly net. The coronis frittilary, caught to complete Ken's pair, escaped and floated away over the bank, across the creek and through the trees. Alex dashed to the toolhouse for a hoe. Walter had caught a small rattlesnake in a butterfly net last week, but this was a big one, and the butterfly net was full of holes where Robbie had snagged it on the blackberries. A posse responded to his whoops and surrounded the bushes so that the snake could not escape unseen. Alex went in after it. We added the skin to the others hanging on a nail on the back porch, and we put the meat in the freezer for our next barbecue. Not that our friends really enjoyed rattlesnake steak, but most of them were polite about it, and, at least, it gave them a conversational backlog for lagging social moments that might occur later.

There are a lot of things that can be collected at Rancho del Oso—rattlesnake skins, for instance, varying only in size and in degree of drabness. Wildcat skins are soft and more useful, but I, for one, will not separate them from the wildcats. One season we gathered seaweed. The ranch is on the northern tip of Monterey Bay in central California. Early spring tides bring quantities of seaweed up on the beach. We already have a collection of seashells, which are lovely, and currently away at a school exhibit.

Then we had "butterfly summer." Robbie started it one day early in May. He came into the kitchen and opened his carefully-cupped hand to show me the orange-tipped white butterfly.

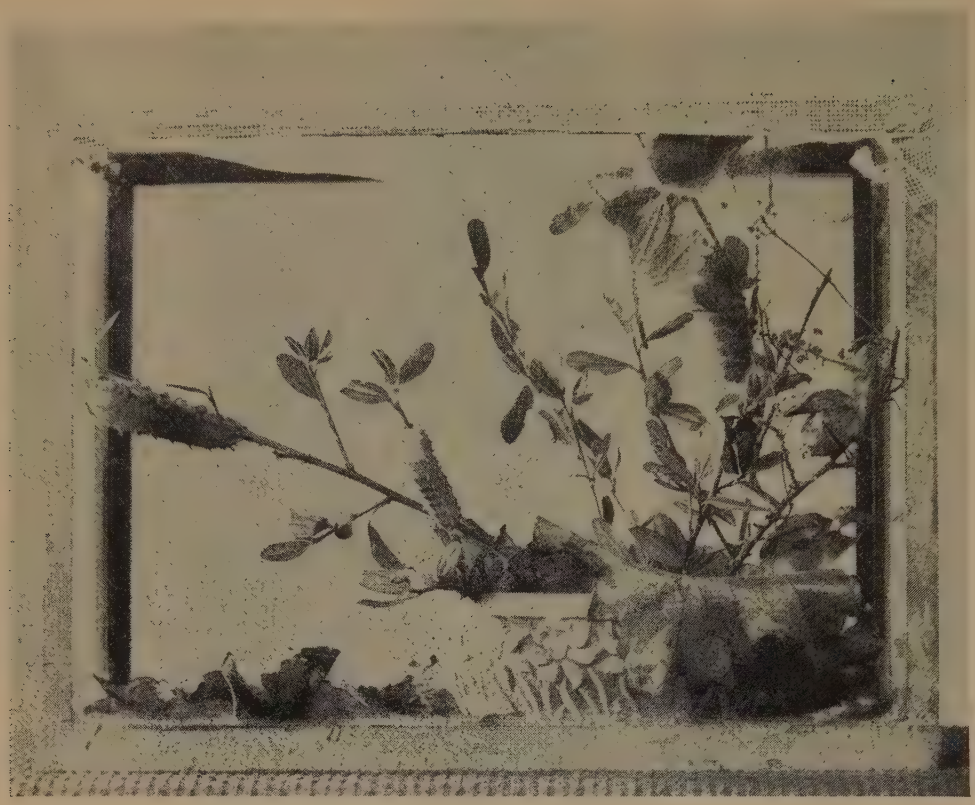
"Look at it, Mummie; may I keep it to look at?"

I wiped the bread dough off my hands and found a jelly glass to put over his treasure, so that he could see it and exclaim over its bright markings.

When Mouse came home from school he made a butterfly net. Together the two little boys roamed the garden paths and the road through the field. They came home with several prizes—the showy Californian sister, black and white and orange-red, with a gorgeous purple-shaded pattern on the under side; the smaller cabbage white; the buckeye with its peacock eyes on the wings. That evening I mounted these, and we had an exhibit. The other children were filled with envy. There was a flurry of questions, and a scramble for the butterfly books. The butterfly project was under way.

More nets were needed, and killing jars, and advice on getting the insects home with their wings undamaged. Nets twenty-four inches deep were made out of mosquito bar and sewn on frames made of twenty-four-inch pieces of baling wire, firmly attached to light, five-foot sticks. We had no potassium cyanide, so put a few drops of Carbona, carbon tetrachloride, on a piece of cotton and put it in a jar with a tight lid. It did a good job, was safer to use than cyanide, but had to be renewed each day. I showed the children how to press the insect's thorax, or middle body, to paralyze it so it would not injure its wings by fluttering in the net, and how to place it in the jar carefully without touching the delicate wings.

Remembering the collecting litter of my childhood —piles of cigar boxes, forests of pins, tragedies of broken wings and lost antennae and insect-eaten bodies—I resolved to find a more compact, durable and attractive method of mounting. Plates of glass, cut the size of sheets of typing paper, plus experiments in mounting, resulted in frames of butterflies lovely enough to use as wall decorations, yet easily filed away. These are mothproof, durable and neat. To make a frame we start with an 8½ x 11 piece of cardboard with a loop of string threaded through one end to hang it by. A few grains of moth crystals (we use paradichlorobenzene) are sprinkled on the card-



An old aquarium was turned into the "Crawly House" and tenanted by caterpillars and cocoons that later developed in specimens for the butterfly and moth collections.

board, then a layer of cotton thick enough so that an indentation the size of a butterfly's body can be made in it. The butterflies, six to ten pairs of them, are laid carefully on the cotton, the glass is laid on top of them, and passe partout is pasted around the edges. On the back of the frames we paste an envelope containing a card on which are the names of the butterflies in the frame. Not the least of the advantages of this type of mounting is the fact that the frame can be passed from hand to hand, looked at and turned this way and that to catch the iridescence and shaded markings.

We mounted two of each kind—four if the males and females differed noticeably—to show both the top and underside. Some, like the Hunter's butterfly and the Californian sister, are much lovelier underneath. The Hunter's, brown and black and white on top, underneath has rose and gorgeous blue peacock eyes.

My job was to keep the nets in repair and do mounting for unskilled fingers. Anne's delicate touch was successful on even the most fragile specimen, but Robbie could cope with nothing less durable than the sturdy-winged monarch. The colored scales, which under a microscope show as brightly-colored shingles on the wings, come off on one's fingers as opalescent dust. It takes skill and patience to handle, or, rather, avoid handling, the butterflies to be mounted. We found that toothpicks are handy tools for placing and weighting the wings and antennae, and we also made good use of tweezers and darning needles. We put tissue paper under the most fragile specimens, specially the small moths, because even the soft fibers of the cotton brushed off their scales. Although we did not always get perfect results, we kept as our goal perfect specimens with no antennae missing, mounted with the bottom line of the forewings at a right angle to the bodies.

Most fun of all were the expeditions after the butterflies. Sometimes we made an excursion up the canyon, the children taking turns riding on the running board of the station wagon as I drove it slowly along the path. At the shout of "Butterfly", I stopped the car, and the one who had spotted it gave chase in his own fashion. Alex stalked his prey. Mouse ran his down by sheer endurance. Robbie ran and whooped and generally stirred up the vicinity. Sometimes I took a net, but if the butterfly would not sit down and wait for me I relinquished my rights to a livelier hunter. As the children disappeared through the trees the butterflies came back. I sat in the shade and watched them dancing in the sun.

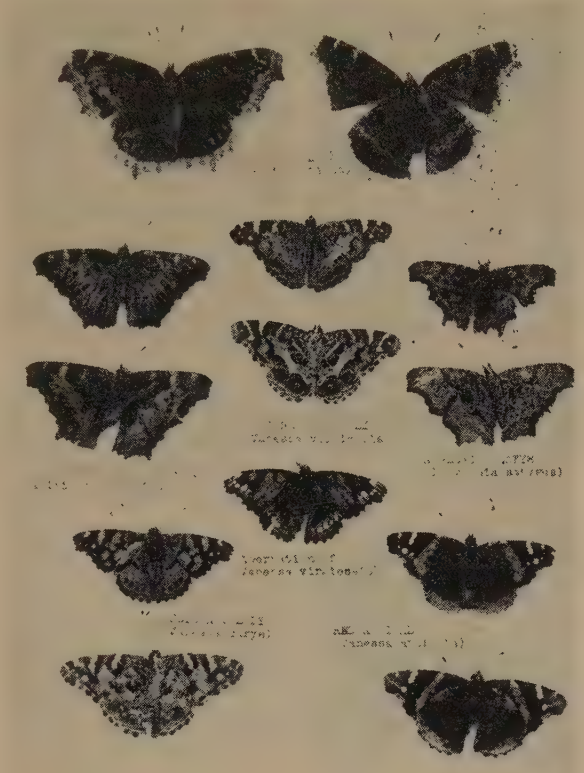
A yellow sulphur floated over a thistle patch. A West Coast lady darted up to meet it, and a buckeye joined them. They whirled together up over the redwoods, separating and away. What were they doing? Not mating, certainly, for they are different varieties. Fighting? It was an airy, casual battle, if one at all. Just dancing, perhaps.

We had our favorite spots. We could always find bright, leisurely-flying Californian sisters along the creek. It was useful to know where to get these, for it was an encouraging start for the frame of a visiting child. The walnut orchard, carpeted with white daisy dog fennel and prickly, blue skunk weed, was a prolific source of my tiny favorite, Behr's blue acmon. Their sky-blue wings are fringed with orange, and at rest they rub them together with a self-satisfied air. The fragile, fluttery, cream-colored ringlets lived in the orchard, as do the darting purplish coppers, whose metallic luster showed violet like changeable taffeta. Here, too, we had many a futile dash after disdainful tiger swallowtails, the king of butterflies. They fly high and fast and seldom dawdle from flower to flower in friendly leisure. Two species of swallowtails were seen during the summer—the creamy zebra,

and the yellow tiger. In the pasture, among the purple thistles, we could usually find the sulphurs, and the energetic, white-fringed Butler's dusky wings. Sunny meadows in the woods held many kinds, especially if there was a damp springlet near.

We learned that butterflies are children of the sun. Only in the warm hours of the middle day were they abundant. Early morning and late afternoon might yield many dragon flies and grasshoppers, but the butterflies were hidden until the sun was high in the sky. We wondered where they went when they disappeared. Mouse spent hours hunting for them among the weeds and branches. Once or twice he found sleeping cabbage whites in the broccoli field, but never any others anywhere. Perhaps their folded wings make them look like leaves and we do not recognize them when we see them.

Once a week we drove the rough, rutted road on the crest of the hill to Last Chance Ranch, where Alex took typing lessons from the "lady hermit." Riding on the running board, the children called frequent butterfly stops. The high meadows were full of dark wood-nymphs, flying close in the tall grass. Once we ran into a recent hatch of coronis fritillaries flashing through the young Monterey pines. Each child caught his perfect pair of these silver-splashed beauties, and the one freed by the rattlesnake was no longer regretted. We stopped under the scrub oaks and shook the branches to startle into flight some oak coppers and bronzed hair streaks. We mounted them on the spot, as they are too fragile to carry without damage.



One of the mounts of specimens that resulted from the "butterfly summer" and introduced the family and friends to the fascinating field of butterflies, moths and other insects.

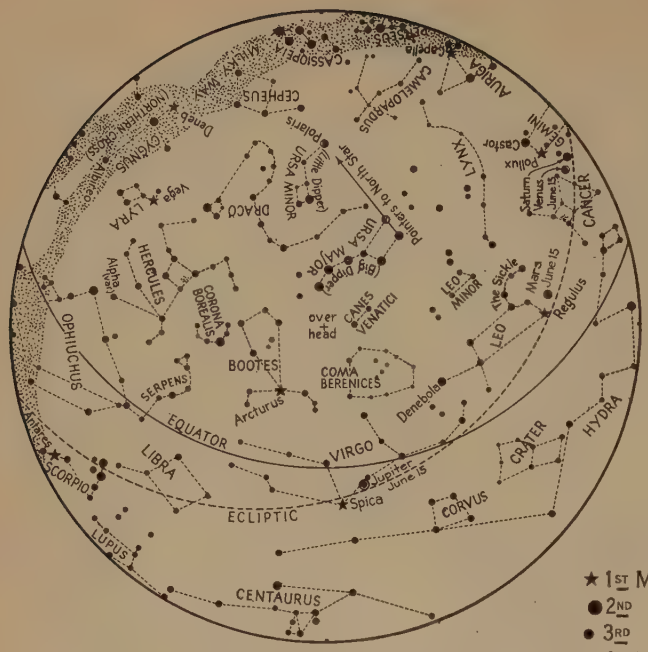
Linda worried about hurting them, and felt sad that we killed them. We were always careful not to injure them, although we knew that their nervous systems were so rudimentary they probably felt no pain. A butterfly's life is very brief, often only a few days. The birds eat many of them, and the wings of others wear out so that they die maimed and bedraggled. Nature is ruthless, and wasteful of her beauty. The insects we caught we killed quickly. In our collections their beauty would live for a long time to be enjoyed by many persons.

Waiting for Alex to finish his lesson, we poked around, looking for interesting bugs for Robbie's miscellaneous collection. We found a potato beetle and a green katydid, and the caterpillars that started our "crawly" project. They were ugly, black caterpillars with brown and black bristles. We stuffed a dozen into a match box, and picked some of the wild lilac leaves that they had been eating.

"Ouch, my hand hurts," said Mouse, sucking his fingers. My own fingers felt as though they had been stung by nettles. The pain burned and spread and an ache went up my arm. The caterpillars' bristles must have been poison. The same pain came sometimes, but not always, when we handled them or the twigs they had been on.

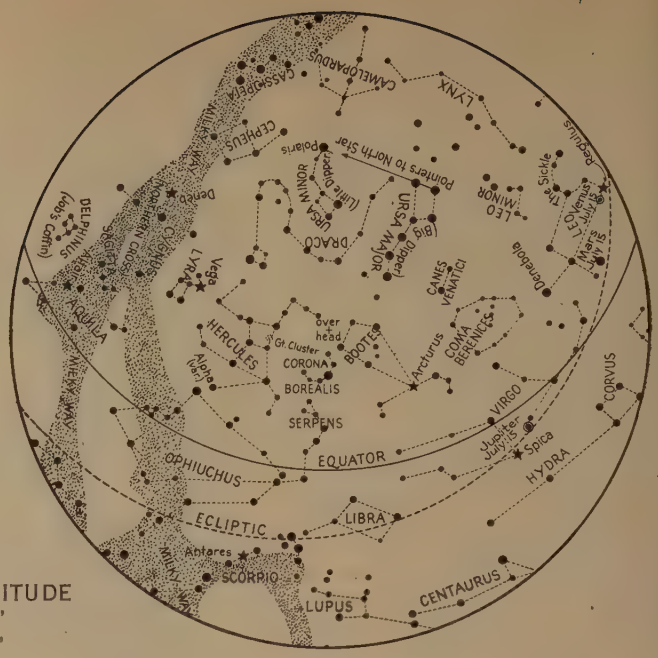
When we arrived home we put them into a unused aquarium. A layer of earth and dried leaves on the bottom, a jelly glass of water with the lilac twigs in it—the water protected from the caterpillars' suicidal impulses—a square of mosquito netting over the top, and our "crawly" house was completed. Every day or two we put in fresh twigs, which we dipped into water to simulate dew for our thirsty guests. We kept them under a window in the kitchen, where they thrived, and, in spite of precautions, made occasional sorties into the kitchen. The family took these in their stride, but we sometimes had nervous visitors. We watched the caterpillars eat, and grow, and shed their skins; eat, and grow, and shed some more. One got small, elliptical, white "seeds" on his coat, and we knew he had been destroyed by ichneumon fly larvae, of which these were the cocoons. We dropped him, and his murderous guests, into the kitchen stove so that they would not emerge to lay eggs under the skin of others. The grubs hatch and eat their host, then break through the skin to make cocoons on his back.

One by one the caterpillars left the lilac leaves and walked around and around the "crawly" house. One of them got out and escaped completely, turning up months later on the window sill, a newly-emerged Edwards' glasswing. I am still wondering where he made his chrysalis. The others marched around and around the aquarium. We put in dead twigs for them to climb and hang on, we gave them a dark box to hide in, but still they crawled around and around for days. They did not look happy. One or two gave up and died. The others (Continued on page 332)



9 P.M., June 1; 8 P.M., June 15.

★ 1ST MAGNITUDE
● 2ND "
● 3RD "
● 4TH "
● 5TH "



9 P.M., July 1; 8 P.M., July 15.

To use these maps hold them before you in a vertical position and turn until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

The Heavens in June and July

By ISABEL M. LEWIS

Most of the planets will be found in the western evening sky during June and July. At the beginning of June all eight planets are in the evening sky, but Uranus passes to the morning sky on June 8, when it is in conjunction with the sun. Saturn, in the constellation of Gemini, is in the western sky in the early evening, until it comes into conjunction with the sun on July 21. For several weeks before this it will be so close to the sun that it will be difficult to observe it in the twilight.

Mercury will be in the evening sky throughout June and July, and should be visible part of this time. As June advances it increases its distance from the sun, and by the end of the month, will be about 15 degrees above the western horizon, and a little to the north of the west point at sunset. It will be in good position for observation early in July for it reaches its greatest eastern elongation on July 5. Mercury is then a brilliant object in the evening twilight, half a magnitude fainter than Vega or Arcturus but more brilliant than Spica or Antares. It will be difficult to find Mercury after the middle of July, for it will then be drawing rapidly in toward conjunction with the sun.

Venus will be a conspicuous and beautiful object in the western evening sky during June and July. Telescopically it will exhibit the gibbous phase, when more than half of its disk is illuminated by the sun's rays. It is on its way from superior to inferior conjunction with the sun, and through greatest eastern elongation, which will not occur until early in September. During these two months Venus will pass from Gemini through Cancer and nearly through the constellation of Leo. About the middle of July Venus will pass within one degree of the first magnitude star Regulus, which is at the end of the handle of The Sickle in Leo. On June 1 there will be a close approach of Venus to the moon, and, in fact, there will be a daylight occultation of Venus by the moon seen from the western states at that time. This occultation of Venus by the moon should be visible even without the aid of a telescope because the planet can be seen even in broad daylight with the naked eye. Observations of it will probably be made telescopically, as occultations are of importance astronomically in fixing the position of the moon.

Mars will be in Leo during these two months. On June 18 it will come within less than a degree of Regulus, passing to the north of it. As the planet is now receding from the earth it is decreasing in brightness. During June it will be about as bright as a star of 1½ magnitude, and less brilliant than Spica or Regulus. By the end of July Mars will be rather low in the west at sunset and unsatisfactory for seeing.

Jupiter, early in June, will be near the meridian at sunset. It has been retrograding, or moving westward, with respect to the stars since early in February, but it will resume its eastward motion relative to the stars after June 15. It will remain in Virgo during these two months. By the middle of July it will be considerably to the west of the meridian at sunset, and will pass below the western horizon before midnight.

Saturn will be poorly placed for observation during most of June and July, disappearing in the sun's rays as it approaches the western horizon, and conjunction with the sun on July 21. In the middle of June it sets about two hours after the sun.

There will be some interesting conjunctions among the planets during June and July. Mercury will be in conjunction with Saturn on June 23, passing 1½ degrees north of Saturn. Venus, in addition to its close conjunction with the moon on June 1, will be in conjunction with Saturn on June 12, passing about two degrees north of it.

In June there will be two eclipses. A total eclipse of the moon on June 14 will be visible generally in Antarctica, New Zealand, Australia, Asia, Europe, Africa, the South Atlantic, and extreme eastern part of South America.

A very small partial eclipse of the sun will occur on June 28-29; an eclipse of the midnight sun, in which the moon's shadow will pass over the North Pole. The magnitude of the eclipse will be 18 hundredths of the sun's diameter at most. In other words, that part of the sun's diameter will be covered by the moon at the time and place of greatest eclipse. The place where the eclipse will be greatest is on the west coast of Greenland, nearly on the Arctic Circle, and it will occur on June 29, 3:51 A.M., Greenwich Time. Small partial phases of this eclipse will occur in Scandinavia, and the North Sea, extreme northern part of the Atlantic Ocean, polar regions, Greenland and the extreme northern part of Canada.

On June 21, 7:45 P.M., Eastern Standard Time, the sun will be farthest north of the equator. Summer will begin then in the northern hemisphere, and winter in the southern hemisphere. The day is then longest north of the equator and shortest south of it.

Essence

By VEGA M. IHSEN

The perfume of
"Lovely Delight, Number 9"
(At ten dollars a dram)
Is quite sour
Compared with the sweetness
Of ground underfoot
In a forest
Soon after a shower!

Can You Catch These Fishes?

By E. E. STANFORD

Ancient English language and modern American slanguage have accumulated many more meanings than words. *Cat*, for example, may mean a four-legged animal with one tail, a rod with nine tails, a lady you do not like, or any one of several kinds of fishes. When it comes to the fishes, ichthyologists straighten things out (to their own satisfaction) by dividing aquatic cats into *Siluridae*, *Loricariidae*, and *Aspredinidae*. After that they get technical. Even when they get the cat-fishes straightened out, there are a good many other elusive swimmers whose names may mean more than one thing.

Here are twenty-one definitions, or suggestions, of twenty-one fish-names that have double meanings. How many can you "catch?" Don't let any of the big ones get away! See page 330 for the answers.

1. Just a little bit.
2. In the plural, a whole lot.
3. Five and one-half yards, or sixteen and one-half feet.
4. Always underfoot.
5. Sometimes attributed to a door on the dark.
6. Old rival of Winchester and Remington.
7. Railroad men use them to stop trains.
8. An old horse.
9. A highway.
10. Barnum said that one was born every minute.
11. This might come from the mumps.
12. Something direct from the sun.
13. Something direct from Heaven.
14. Plant this to raise jack o' lanterns.
15. Yesterday's synonym for today's "eager beaver."
16. A prickly pear.
17. Bonny heather.
18. A hardwood tree with soft wood.
19. To criticize.
20. A disagreeable household insect.
21. A quarantine flag.

The School Page

Edited by E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

SHORE BIRDS IN THE CLASSROOM

WHEN I was a school boy, the height of my interest in shore birds was reached during the fall migration. I remember that a group of us used the call of the greater yellowlegs as our private whistle, and how anxious we were to get out of school to get to the "marl ponds" to try our skill at shooting these birds, then considered game birds. I am rather ashamed of what I did then, but it is my recollection that the birds were quite well able to take care of themselves. I doubt that I ever seriously reduced the population of my home territory. I am delighted that these birds now get better protection under the laws of the United States, and hope that one of the next steps in American solidarity will involve the recognition of the fact that they need protection in the southern part of their range. With some species this extends far down into South America.

I wonder how many teachers take advantage of the fact that many of these shore birds make enormous annual journeys, flights that show not only the facts of geography but the necessity of international understanding. Few examples prove to us the importance of the "one world" philosophy better than these birds, which are sold by the thousands in South American markets but protected from killing in the northern part of their range.

It is needless here to repeat data on the range and routes of the different species; the essential details are given in the insert section of this issue of *Nature Magazine.*

There is a great difference between the picture of a shore bird, or a stuffed shore bird, and the live, free bird itself. No one can appreciate birds, whatever species they may be, until he has had the opportunity of seeing them in action. This is true whether it means watching some sanderlings on a surf-beaten shore or observing the commoner inland killdeers or spotted sandpipers. The relationship between the long legs, and the correspondingly long neck or bill, and the area in which the bird does its feeding, cannot be fully appreciated by reading of it in a book. A picture of the avocet, for example, shows a beautifully upward-curved, slender bill and attractive coloring, but really to enjoy this bird you must see it swish that bill from side to side through the shallow water when it is getting a meal. There is nothing in the books that adequately portrays the flight of a killdeer, the call of a yellowlegs, the hiding ability of a young phalarope, or the behavior of a stilt trying to lead you from its precious nest. All these must be seen in their natural setting to be appreciated. A moving picture may help, but even it lacks the mosquito-filled atmosphere, the soaking wet feet and the mud-smeared clothes that go with first-hand experience.

Teachers of English are prone to limit their studies of these interesting birds to philosophical poetry. Yet the birds offer other English and language possibilities. Take the common names of the birds and see how many of them refer to behavior, how many attempt representation of sounds, how many refer to color or to pattern, and how many to geographical distribution. With these in mind, try to "unhash" such a mixture as Hudsonian curlew, tip-up, killdeer, sanderling, spotted sandpiper, ring-necked plover, greater yellowlegs, and so on. True, some of these birds have a number of common names some of which refer to behavior and some to pattern, but that shows how a language grows and how man often attempts to express himself through a truly descriptive language. The inadequacy of such names need not be considered too seriously below the college level, if then, but these common names do serve a purpose, and that purpose should be put to use in the lower school levels.

The shore birds provide excellent examples for high school students, and for older students, to recognize the danger of drawing conclusions on inadequate data. For the most part, we are inclined to assume that the duties of nest building, incubation and care of the young are the prerogatives of the female of a species. Possibly because of this, we have long assumed that, when the sexes are colored alike, the bird that performs these duties is the female. An examination of the section on reproduction in the insert will show how dangerous such an assumption may be. Many of the standard bird books have erred on matters of this sort because the necessary information was not available at the time they were prepared. In many cases, only a detailed examination of the anatomy of a collected bird can give the desired information, and such studies, of course, must be reserved for specialists.

The nest-building habits, or the lack of such habits on the part of many of these birds, provide worthwhile studies. Many species lay their eggs in what seems to be the most exposed of situations, while others conceal them exceptionally well under overhanging vegetation. How the birds avoid detection under these circumstances is obvious to anyone who may have located a nest, left it and attempted to return to it from some distance. The shape of the eggs and their position in the clutch make an interesting study when it is remembered that these relatively large eggs must be brooded by a relatively small bird. Usually, they are so placed that their smaller ends are towards the center, and, because of this, the clutch can be crowded into a smaller area than would be the case if the larger ends were towards the center. This may be demonstrated with eggs in collections that may be available, or even by using paper representations of the eggs.

Of course, some child may ask why such small birds lay such large eggs. This opens the way for a rational discussion of the whole story of the precocial type of bird, with which it is essential that the young bird reach a certain degree of independence soon after hatching, if it is to survive. This prolonged development within the eggs naturally calls for adequate provision for that development, and this, in turn, calls for some increase in size. The demands of incubation of these large eggs calls for a reduction in number per bird, although it is true that many precocial birds, such as the common hen, lay large numbers of eggs, much to our good fortune.

I think that the real fun of working with these birds comes with trying to stalk them in the open. I know that this article deals with the study of the birds in the classroom, but if their study would break down the walls of the classroom and move the classroom out of doors, a distinct advantage would have been developed. If the teacher is afraid of getting wet feet, or of losing class discipline by getting the pupils into the open, then it is possible there is a need for some new kind of teacher.

On Such a Day

By ALLEN E. WOODALL

On such a day I dream of hills . . .
When all the waking prairies lie
Sweet with the flutes of meadowlarks
Under a suddenly blue sky.
On such a day I see a road
That leans against the side of a hill,
Then wanders down and far below
And through a valley town, until,
Climbing a ridge against the cloud,
It takes me with it, far away . . .
The larks should not sing quite so sweet
On such a day.

Legion Broadcast

"This Is Our Duty" is the title of a series of programs, heard each week over a transcribed network of radio stations and originated by the American Legion. The objective of this series is to present and discuss problems of returning servicemen and questions of community, state and national interest. During the week of July 7, 1946, the program will be devoted to conservation of natural resources, with a highly dramatic story of a forest fire. Leading radio personalities take part in these broadcasts. Local papers should be consulted for announcement of the scheduling of this transcription.

Horseshoe Lake

In our editorial in the March, 1946, issue of Nature Magazine we called attention to the reprehensible slaughter of geese on the Horseshoe Lake Refuge, owned and operated by the Illinois Department of Conservation. We are now happy to report that the U. S. Fish and Wildlife Service has announced that shooting of wild geese will not be permitted in Alexander County in southern Illinois during the 1946-47 migratory waterfowl hunting season. The refuge is located in that county.

"The flock of Canada geese which winters at the Horseshoe Lake Refuge presents one of the most serious and difficult problem in wildlife conservation at the present time," said Albert M. Day, director of the Service, in announcing the closed season. "The only way to maintain this flock of geese in numbers approximating its present size is to give it absolute protection from shooting for an indefinite period."

Mr. Day points out that if the slaughter of 1945 was allowed to continue the entire flock of some 26,000 birds might be wiped out in a single season. Approximately five birds a minute were killed in the 1945 shooting season, which lasted twenty-two and one-half hours over a five-day period. Since controls applied failed to stop the slaughter, complete protection was the only course.

Soil Conservationist

So much needs to be done in the whole broad field of conservation that, to conservationists, progress often seems maddeningly slow. Then come such announcements as that from the Monongahela Power Company, reporting the employment of a trained soil conservationist. This company serves thirty counties in northern West Virginia, and border counties in Ohio, Pennsylvania, Virginia and Maryland. It is, therefore, interested in agricultural development in its area, and maintains a department to aid this. Recognizing the basic importance of soil conservation in any agricultural program, the company has retained the services of Walter C. Gumbel to work in this field.

Fish and Wildlife Briefs

With the retirement of Dr. Ira N. Gabrielson and the advancement of Albert M. Day to the post of Director of the U. S. Fish and Wildlife Service, Dr. Clarence Cottam has been named Assistant Director of the Service. Combining the scientific with the practical viewpoint, Dr. Cottam has headed the Division of Wildlife Research, and has long experience as a biologist.

Almost five and one-half million young fish from hatcheries operated by the Fish and Wildlife Service have been "planted" in farm fish ponds during the past year. Largemouth black bass, bluegill sunfish and ten other species have gone into 9529 individual farm ponds, most of them one to five acres in area. Three leaflets on farm fish ponds are now available from the Service.

Tishomingo and Hagerman National Wildlife Refuges have been established in the Panhandle area of Texas and Oklahoma. Both of these new resting grounds for waterfowl are on a part of the huge Texoma Lake area formed by the construction of Denison Dam on the Red and Washita Rivers. Twenty-three thousand acres are provided by the refuges.

Wildlife Institute Change

Announcement is made of the formation of the Wildlife Restoration Institute, which will absorb the present activities of the American Wildlife Institute and "set up a complete service and research organization better to correlate and advance the activities of cooperating agencies in the field of wildlife restoration and conservation." Dr. Ira N. Gabrielson, recently retired Director of the U. S. Fish and Wildlife Service, is the President of this Institute. A Foundation, headed by Frederic C. Walcott, has been created "to render moral support and financial assistance to wildlife restoration and conservation in much the same manner as existing foundations are advancing the cause of public health and education."

The Physical Sciences

Science in a Changing World. By E. J. Cable, R. W. Getchell and W. H. Kadesch. New York. 1946. Prentice-Hall, Inc. 622 pages. Illustrated. $5.00.

This book is a revised edition of the original volume published in 1940. Its authors are members of the faculty of science at Iowa State Teachers College. In the six years since the original edition many advances have been made in the field of the physical sciences. This required rewriting of several chapters, revision of bibliography and incorporation of new material, illustrative and textual. The result is an up-to-date textbook.

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Camera Trails

By EDNA H. and WILLIAM J. EVANS

It is downright encouraging, if not actually appetizing, to see the number of new cameras, photographic gadgets and darkroom devices that are finding their way back into the camera stores.

Some of these are shortcuts, developed because of wartime needs. For example, Kodak Universal M-Q developer can now be bought in little packages that, at first glance, look like folders of paper matches. Some chemical reagents, such as Kodak Anti-Fog No. 1, are now being sold in tablet form—all the photographer need do is draw off the required amount of water, drop in two tablets, stir well, and into the darkroom he goes.

Another wartime development that fascinates the writers is the Kalart focuspot, which operates in connection with the Kalart synchronized prism range finder. This handy device permits focusing under poor lighting conditions, or even in absolute darkness. Built into the barrel of the battery holder, it operates with a tiny switch, which, when pressed, sends out a strong beam of light from a window in the barrel. All the photographer has to do is focus where the light hits and press the button. Flash—and his picture is taken.

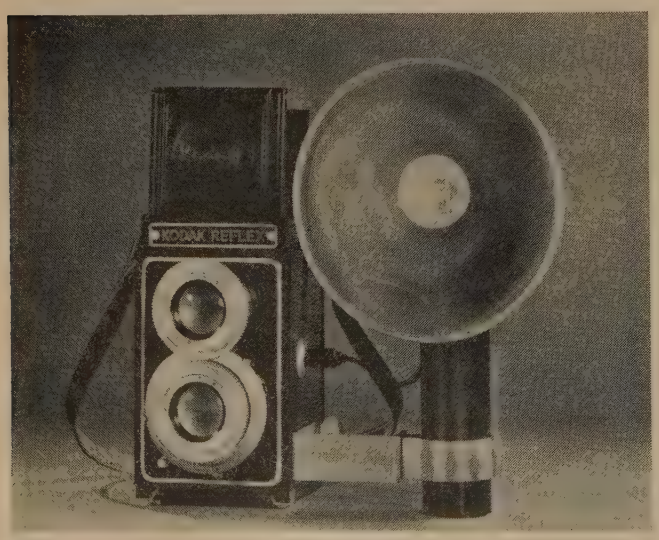
Safelight boxes have become streamlined so they now look like the headlights on diesel locomotives rather than darkroom aids. Then, too, because of wartime shortages, many of the models were made of plastic. Question: How popular will plastic be, with the return of metal?

TWO NEW CAMERAS

As for new cameras. The Eastman Kodak Company has announced two new models. One, the Kodak Medalist II, described as a "fine precision miniature camera," was to reach some dealers during April. Deliveries of the other, a new twin-lens reflex camera, were to begin to dealers some time in May.

The Medalist II is equipped with a between-the-lens shutter with nine speeds—from one second to 1/400th second and "bulb"—plus adjustments so the camera will operate in accurate synchronization with a flash gun. It also has an improved film transport system that prevents double exposures (bless it!)

This new twin-lens Kodak reflex camera is the first completely new Kodak to be announced by the Eastman Company since the war ended. It has f/3.5, 80mm lenses, seven shutter speeds and can be used with a flash attachment.



This dew-spangled spider web was a difficult subject to photograph because it faded so completely into its natural background. But by standing behind it the auxiliary cameraman provided a background—dungaree-clad trouser legs.

and automatically cocks the shutter. An accessory back, which permits the use of ground glass for focusing, sheet film and film packs, also can be had for the camera. It takes a picture 2¼ by 3¼ inches.

The twin-lens reflex model is the first completely new Kodak to be announced by Eastman since the war ended. Both lenses are color corrected and the taking lens is "Lumenized" to give increased negative brilliance, color purity and to reduce lens "flare." The shutter has seven picture speeds—½ second to 1/200th, time and bulb—plus adjustments so the shutter will operate in synchronization with a photoflash attachment.

Engraved on the housing that covers the finder lens tube is a depth-of-field scale so the photographer can tell at a glance the depth of field he will obtain at his selected diaphragm opening and subject distance. A red dot on the scale indicates the focusing compensation to be made when using infrared film. The twin-lens Kodak takes pictures 2¼ by 2¼ inches. It comes in a brown leather field case.

RAPID-PROCESS PAPERS

Along with the two new cameras, the Eastman Company also has developed two new rapid-process papers for contact printing and enlarging. These can be completely fixed in two minutes, completely washed in four minutes, and will dry in an extremely short time.

The papers, again, are the result of wartime developments. The Army and Navy needed a practically waterproof paper that could be processed rapidly in the field. Kodak Resisto and Resisto Rapid are the result.

Duck fashion, the papers shed water because of a base made practically waterproof by an impregnation of acetate. They have such a low percentage of shrinkage or swelling that they will not appreciably change shape during processing and drying. This characteristic is most important in commercial and industrial copy and reproduction work where true-scale results are important.

From the amateur's angle, the speedy developing and drying features cut down time spent in the darkroom. This helps commercial cameramen, too, by reducing the time needed for rush jobs. Of course, everybody has his own favorite papers—but these new ones are worth a try in anybody's darkroom.

BACKGROUNDS

Background, according to the dictionary on our desk, is "the distant portion of the landscape, the portion of a picture farthest from a spectator, a place obscure or out of sight." That is all very well but, to a Nature photographer, background can be a decided pain in the neck.

As a rule, the Nature photographer has to take his picture where he finds it. Otherwise, it could scarcely be called a "Nature" picture. Of course, some stage setting is possible. There are good ways to dodge that soft drink sign nailed to the picturesque old oak tree. In fact, a hammer and a couple of whacks will relieve the landscape of another eyesore.

Certain bits of unnecessary foreground can be removed—long grass blades clipped or intruding twigs broken off. But it is the things in the background that cause most trouble. Not because they stand out, but because the foreground blends into them so well.

Nature is a master hand at camouflage —naturally, since Nature invented and perfected this type of disguise. Notice how even the brightest colored birds can disappear with amazing speed, how the fawn's spots match the sun-dappled shade where the doe has hidden it, how the black snake looks like a fallen branch and the chipmunk like a bump on a log —until they move.

Sometimes nothing at all can be done about backgrounds. On the other hand, ingenuity on the part of the cameraman sometimes saves the day. Take, for example, the dew-spangled spider web that illustrates this installment. We came upon this jewel-and-lace design early one foggy morning. Its background was impossible —dewy grass and twigs so completely absorbed the web that it could scarcely be seen on the camera's ground glass.

So what did we use for a background? A pair of dungaree pants, complete with wearer inside. The dark blue gave sufficient contrast to make the dewdrops stand out. Yet, if we had not told you, would you have given a second thought to the background?

PHOTOGRAPHIC PATRIOTISM

Pre-war German lenses enjoyed reputations for being far superior to any made elsewhere. But recently the conservative British handed a compliment to American-made Leica lenses and the universal viewfinder now being manufactured in this country by E. Leitz, Inc. A Leitz release tells of praise accorded that company's products when tested and compared with similar ones of pre-war German manufacture.

The compliment came from the editors of "Amateur Photography," a weekly British photographic publication. It tickles our patriotism, as well as our national pride, to hear that USA-made lenses can be tops—although, of course, we suspected it all the time.

Unfinished Business

It would be a most salutary thing if every member of a State Legislature, every member of a local school board and every leader in parent-teacher organizations could have a copy of "Unfinished Business in American Education." This is a 64-page booklet, subtitled "An Inventory of Public School Expenditures in the United States" and published by the American Council on Education, 744 Jackson Place, Washington 6, D. C. It would be futile to attempt to summarize the illuminating, grievous and startling facts presented in this publication. Succinct text and graphic charts in the booklet must present the case, and it is an exhibit that suggests that before we set out to reform the world, and tell other peoples what they should do, we have a tremendous amount of unfinished business of our own in that fundamental of all fields of progress—the public school. Copies of this booklet are available at one dollar each, and at lesser prices for quantity orders. A number of copies would be a worthwhile investment for every parent-teacher and home-school organization in the United States as a means to waking people up.

Pigeon Veteran

"Kaiser," veteran of two world wars and two armies, recently celebrated his 29th birthday at Fort Monmouth, New Jersey. He is a carrier pigeon, who emerged from his egg in February, 1917. He was trained by Kaiser Wilhelm's troops and captured by Yanks during the Meuse offensive of 1918. Brought to the United States, he was the progenitor of several birds who went to war in World War II. One of these, "Little Caesar," won a 320-mile race from Dallas, Texas, to a Missouri camp. Still wearing his original German Army leg band, "Kaiser" is thoroughly American and lives in retirement at Camp Crowder. He is believed to be the oldest homing pigeon in the world, his record long life amazing pigeon fanciers. Upon his death "Kaiser" will be mounted and placed on exhibition at the U. S. National Museum in Washington, later to be returned to the Army for its collection of avian heroes.

Man Wanted

Word comes from Miss Lucy Furman of the National Association for the Protection of Furbearing Animals that she is seeking a young man to be the executive secretary of that organization. He must be a good speaker, and, of course, a lover of animal life. Miss Furman has had in mind some veteran who may have suffered physically from war service, and who might therefore be more sensitive to suffering of animals. Anyone interested should get in touch with Miss Furman at 302 Wilkinson Street, Frankfort, Kentucky.

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RED FOX—RESOURCEFUL RESOURCE

(Continued from page 297)

spends most of his time trying to give someone a vulpine hotfoot, and glories in his reputation as a scoundrel. He resents friendship and repays hospitality with rudeness just for the fun of being ornery. His exemplary acts he does his best to hide. Take his voice for example. He has a normal bark somewhat like a Pekingese with a Harvard accent, ending in a drawn out *yurr* as though the animal had suddenly been transferred to Yale. But if he thinks anyone is listening he switches over to a number that sounds like two tomcats tied together by the tails and hung over a clothes line.

What is to become of him? The Devil only knows, and he probably would not bet on it. Not without odds, at least. Look at what happens every time small game hunters start agitating for a bounty on the critter's neck. Orchard owners, chewing their finger nails to the elbow because of mice and rabbits, immediately demand a bounty on the hunters.

WILD CHILDREN OBEY

(Continued from page 300)

fore. But the parents would not allow the birds to stay in the nest for a moment. They had been in mortal danger there, and never again must they be found near it.

"Come! Come! Come!" they pleaded. "Come away!" And the little fellows, who understood the call so perfectly, hopped after them into the bushes. Although normally too young to leave the nest, they grew to maturity in the shelter of the underbrush.

A family of flickers gave us the most interesting demonstration of obedience that we have ever seen. These young birds lived in a hole in an old oak, and were almost ready to leave home. They were fully feathered and spent most of their time pushing and shoving to see who could reach the farthest out of the hole, and consequently be fed first. The uproar they set up when their father or mother arrived with food was astonishing.

When the big fellows showed every evidence that they were about ready to leave home forever, Herschel took them out of their hole and set them on a stub for a picture. He had arranged the stub and focused the camera on it before he brought the young birds down. Our two boys and I each held a bird on the stub until Herschel was ready, and then we all let go while he snapped the shutter. But the young birds were faster than we, and all we were getting were blurred pictures of birds taking off. Over and over we gathered the flickers up from their perches in the nearby shrubs and stood them on the stub, braving the painful jabs of their long, sharp beaks.

By a great deal of patience and perseverance we took several pictures. The old flickers were not around during this time, but suddenly one swooped by and alighted in a tree. She watched us a moment, and then she made a peculiar purring call. Instantly the three young birds "froze." We removed our hands from the birds and stepped back, but they did not move an eyelid, I was reminded of days when we played "statue," trying to hold as long as possible the positions into which we were placed.

We took several pictures of the birds, even moving the camera closer, but not one movement did they make. We went away a short distance and sat down under the trees, waiting for the next signal that would break the spell. The young birds grew tired. The head of one slowly drooped backward. The mother called again and he straightened back to the original position. The flicker on the top of the stub had been sitting with bill pointed up and slightly open when its mother first gave the signal, and he did not move even to close his bill.

We watched this strange tableau for twenty minutes, or more, waiting to see what would happen, but nothing did. Our pity for the little birds in the hot sun grew until finally we took them from the stub. They offered no resistance as we put them back into the nesting hole.

Is it because birds grow up so fast, and have to meet the emergencies and struggles of life so soon after they have arrived in this world, that this marvelous instinct of obedience and understanding is given them? We do not know. But it is to this quick and unquestioning response that most young birds owe their lives, for if they were left to learn by experience the meaning of the signals given by their parents few if any would survive the precarious period of babyhood. Surely it is a wise Providence that teaches these little wild babes to obey.

UNUSUAL FINNY HEADS AND FACES

(Continued from page 319)

His artist most surely never saw a Japanese soldier.

When one considers the figures of little ocean sunfishes, the resemblances to the heads of men are guaranteed by the photographs. But the drawing of Mitchill's baby ocean sunfish is surely at least fifty percent artist. Mitchill evidently never saw the drawing until the plate was printed, and then he was surely horrified for he had another and quite normal figure drawn, engraved and published as an insert with his plate. The picture of the little *Masturus* is presumably well drawn, but the resemblance to a human face is quite far-fetched and requires a good deal of imagination.

Jaekel's reconstructions of fossil coccosteid fishes are based on the fossil bones as gotten out of the rocks and assembled to reproduce the skulls. They were probably done with all the care and accuracy possible. They were not meant for human caricatures and the resemblances are purely accidental.

The angry swordfish is a fine character-drawing, and Tobin's striped trunk fish, when shown in lateral aspect, seems different mainly in detail from certain highly-colored and marked tropical fishes that I have seen at Tortugas and at Key West, Florida. The lines on the side undoubtedly cross the face to join up with those on the other side. Whether or not the artist has "improved on" the facial outlines and on the structures of the face cannot be said without having a specimen in hand.

And so with this presentation of figures and of facts—or, at any rate, of allegations—deponent rests his case. If any others have dredged up similar unusualities, deponent would be pleased.

Green Thumb Prizes

Responding to the urgent appeal of President Truman for more food gardens, the National Garden Institute announces awards totalling $1950 in Victory Bonds in the 1946 Green Thumb Contest. Two classifications are provided. One of these is adult, and includes home and company gardens; the other is for young people, and includes elementary and high school gardens. Full information may be obtained from the National Victory Garden Institute, 598 Madison Avenue, New York 22, New York.

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SAND SPOOR

(Continued from page 303)

tween low tide and high, solitary furrows traced the path of clams. Studied closely, we found the trails to have a regular change in depth and width. Here the clam had stretched its slender, pointed foot into the sand ahead, pushing its limy valves just a little higher in the groove. Foot anchored well and swollen at the tip with blood-filled vessels, the mollusk had pulled its shell along and into the sand, producing a short extension of the groove. The new part of the trail became broader and deeper as the clam's movement reached its final point. Again the animal had reached forth its foot. Again the shell had raised up in the end of its track, only to be pulled obliquely down and make another sloping, slanting channel in the sand. From these features of the clam trails we could read the direction in which the mollusk traveled. Often the track vanished abruptly. But when we dug down into the sand at this spot, we found the creature, buried and wet, waiting for the tide's return.

Near one clam furrow was a trail of shuffling feet dug deep into the beach. Extending on each side of it for a short distance, the sand had been leveled as though by a bulldozer blade. This was a track we recognized, although we had not seen one like it for years. A horseshoe crab had made it! Here was a trail connecting modern times with the very distant past, for the horseshoe crab is the solitary living species from a great group now otherwise extinct. Actually more a spider than a crab, this relic of an ancient race is broadly covered by a brownish shell, which protects its legs, mouth and gill plates. Trailing behind it is a long, stiff tail, which the animal can raise into a vertical spike when threatened by some danger. The tail, too, made a trace along the beach. Once seen, both horseshoe crab and track are remembered forever, and seldom confused with any other. Our previous acquaintance with these creatures had been on the bay side of the same cape, when the northward-moving migrants of this amazing animal crawl out upon the mud flats in hundreds. Just as man is likely to exterminate the turtle by hunting out its eggs for food, he is making serious inroads on the numbers of the horseshoe crab. Fertilizer factories on the Jersey shore open in the spring as the crabs appear, and grind them up in wholesale fashion until the season passes. Man may accomplish in fifty years what Nature has not done in millions. He may destroy these harmless horseshoe crabs and end the last survivor of an anachronistic animal.

Flying from place to place along the wave-soaked shore were small, sand-colored, active tiger beetles, searching for tiny bits of animal matter. The frisky beach fleas fall prey to these insects, but even dead relatives cast up by waves are used for food. Sometimes a tiger beetle ventured into the dry sand farther up the beach, and left a trail of tiny footprints as it raced along with periodic stops. We followed closely to see the marks, but, unless we watched where the insect ran, its trail was too fine to recognize. The sun had become too high to cast shadows in beetle trails and make them a photogenic subject. Even the spot where the insect took to flight to return to the wet beach and its search for food was unmarked by any distinct print. The beetle was enough lighter than the grasshoppers that it scarcely disturbed the sand.

A larger creature of the damp sand ventured inland from time to time and left a well-marked trail. The little beach birds ran along the strand, one foot after the other, too quickly for the eye to follow individual steps. Like the tiger beetles and grasshoppers, the birds themselves are not easy to discern, blending as they do with the beach sand, squatting on the sand at intervals so that even their black shadows disappear. But the tracks in the parched sand consist of well-spaced series of four-toed prints, three toes forward, one long toe behind. As each foot is raised and the bird runs on, the middle forward toe drags and makes a dash-like groove between the other marks.

Wherever a breeze springs up, one other type of trail takes the place of all of these. Often when we returned to the beach, it was the only trace we found. The ghost crabs had plugged their burrow mouths. The dry grains had drifted into the little hollows and all the tracks, and filled them full. The sand piled up in windrows on the beach and ripples formed among the dunes. But the grasses blew from side to side, their drooping blade tips etching arcs as they swung to and fro. These circling furrows around the grass clumps and the ripples on the bare beach marked the way the breeze blew; its speed and its direction. In a sense, they too were sand spoor. They showed the path of the wind.

BUTTERFLY SUMMER

(Continued from page 323)

finally dug into the dirt, where they made hard, brown chrysalids.

The moths particularly intrigued me. There were so many of them and yet we saw so few. Not many of them flew in the daytime. A few we caught among the flowers with the butterflies—the dark-blue Ctenucha with white bands and red spots, and the creamy and gray boll moths around the wild radish blooms. We had no luck with baiting, smearing molasses and beer on tree trunks, so I tried attracting the night ones by leaving my bedroom window open while I read with the light on. Mosquitos came in, and bats; also moths, including a few fragile green ones and a lot of small brown ones with pearly, iridescent underwings. But Chuck said it disturbed his sleep to have me leaping around the bedroom with a butterfly net.

Altogether we caught and mounted about seventy kinds of moths, but we were able to identify less than twenty. We are waiting for someone who knows about them to come and help us. We caught and mounted about forty kinds of butterflies and made good identifications of all of them.

We are making a life history frame of the *Samia rubra*. We have the little eggs, with neat round holes in them where the babies crawled out. We have pressed a twig of wild lilac with a big green caterpillar on it. The caterpillar is a water-color picture as we have never found a lifelike way of drying and mounting the real thing. A silver cocoon will be added as soon as the moths are through with them, and we are waiting for the moths to hatch so we can get a perfect specimen of them to complete the frame.

Many, many of the summer evenings were spent poring over the butterfly books, looking at the pictures and reading the descriptions to find the names of those we had mounted. There are several fine books to help the collector in California. We have *The Butterfly Book* and *The Moth Book* by W. J. Holland, and we went to the public library for *Butterflies of California* by Dr. John Adams Comstock, and *The Butterflies of the West Coast* by William Greenwood Wright. Usually we were able to make positive identifications, but sometimes we were not certain sure.

We made a butterfly notebook with three columns in it. In the first one we wrote the butterfly's names (both everyday names and scientific names) and the wing tip to tip measurement of a typical specimen. In the second column we wrote down a description of its colors and markings. In the third column we made notes on its habits, such as when it appeared and where it liked to live, and anything we found out about its early life.

Summer turned to autumn and there were few butterflies left as the nights grew chilly. On warm days, however, the monarchs still floated lazily up and down the coast, and the cabbage whites hovered over the broccoli fields. One Indian summer day in October, hundreds and hundreds of tortoise shells appeared. They drifted across the highway in clouds and settled by scores in damp spots in the garden. The next day they were all gone, not even a dead one left to tell what had happened to them.

The summer was over, but we had more than the memory of it left; we have the butterflies. Their usually brief beauty shines in long-lived iridescence from the frames in my children's rooms, and among the treasures of the other children who shared our "Butterfly Summer."

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11. The association will not accept for publication in NATURE MAGAZINE, advertisements of firearms, ammunition, or patent medicines.

12. *Responsibility for illegible copy:* Type or print advertisement plainly as we cannot be responsible for errors due to illegible writing.

13. *Closing date:* The closing date of all advertisements is the 20th of the second month preceding month of issue.

With this issue of Nature Magazine we offer this new service to members and readers, as described above. Through the years we have had many letters from readers wishing to know where they could buy various specialized articles. Others have had articles of which they would like to dispose. The Reader's Market will thus reach a large and specialized audience for such transactions. It is important that orders of space and copy be gotten to us as quickly as possible.

Under the Microscope

By JULIAN D. CORRINGTON

SPONGE SPICULES

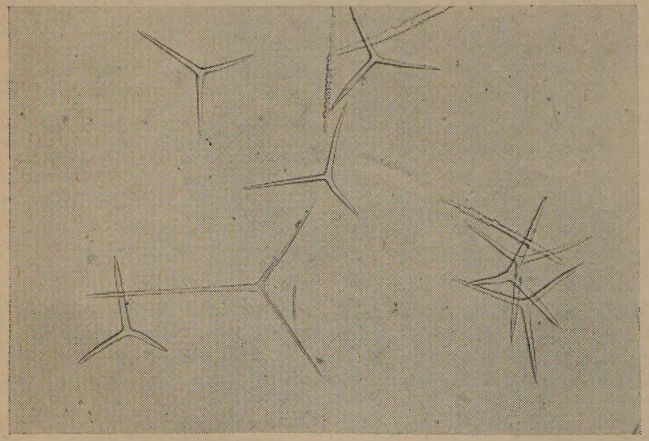
AMONG THE wonders of the organic world are the doings of one of the lowliest of peoples—the sponges. These creatures, thought to be plants until as recently as 1857, because of their attached method of growth and lack of locomotion, are members of the animal phylum Porifera (pore-bearers). They are always aquatic, mostly marine, with a single freshwater family; they are always sessile (attached) as adults, and mostly independent, although the boring sponges are parasitic and constitute one of the worst pests on oyster beds. A few have a simple vase shape, but the majority are branched or compounded into massive objects of characteristic shapes.

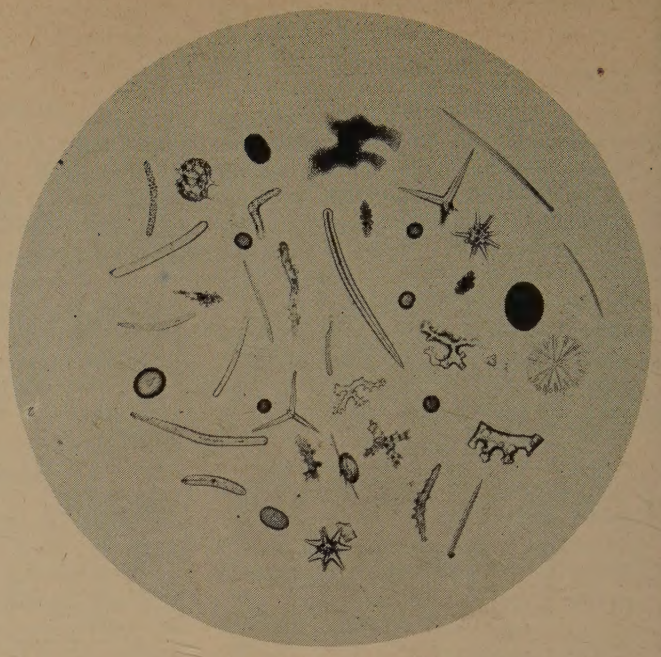
Although the some 3000 described species of sponges differ in many respects, the distinction selected as a basis for the primary divisions of classification has to do with the skeleton. In composition, the skeletal elements may consist of lime or calcium carbonate, hence termed calcareous; of opal, a hydrated silica similar to glass, and called siliceous; of spongin, a structureless organic secretion allied chemically to horn or silk; or of both silica and spongin. One group, the slime sponges, has no skeleton at all.

The calcareous and siliceous material occurs as simple to complex bodies, primarily needle-like, termed spicules; the spongin forms interlacing and branching fibers that make up a porous mass so characteristic of the condition that the adjective "spongy" is commonly used to denote a similar construction in many other materials. Sponge spicules are microscopic or, at the largest, elongate and hair-like, and provide excellent and attractive whole-mount subjects for the microscopist. They occur as fossils as well as in living specimens.

The first group of sponges is the Class Calcarea, characterized as having spicules wholly of the calcareous type. *Grantia* and *Leucosolenia* are well known laboratory examples. The Class Hexactinellida consists of sponges with six-rayed or triaxon siliceous spicules and are all deep-sea species, as Venus' Flower Basket, *Euplectella,* and the Glass-rope Sponge, *Hyalonema.* In the highest assemblage, the Class Demospongiae (sponge people), are placed those having a skeleton of silica but not triaxon, of a combination of silica and spongin, or of spongin fibers only. This, by far the largest group, contains the freshwater sponges of the Order Monaxonida, Family Spongillidae, and the Order Myxospongidae, the slime sponges. Typical members of this class, however, are large compound marine masses, including the bath sponge, *Euspongia,* and related types that are mostly too coarse for commercial use.

Triradiate spicules, 120X.





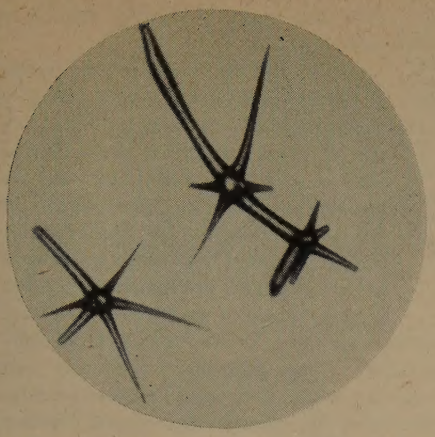
Arranged slide of spicules, 65X.

Spicules are classified according to number of their axes as monaxon, needle-like and hence with a single axis; triaxon, tetraxon, irregular, and so on, some of these types having subdivisions. In appearance some resemble miniature tuning forks, or anchors, double-ended anchors, apple cores, buttons; in fact, a great variety of intriguing shapes are presented by these minute bits of lime and glass. As the classes of sponges are based on composition of the skeleton, so in some cases are orders erected according to spicule shape, as the Monaxonida and Tetractinellida of the Class Demospongiae.

Spicules are non-living structures. The method of their formation by living cells has been worked out in detail and is a most remarkable performance, requiring an unbelievable amount of labor. Since either the lime or the silica must be extracted from the sea water, and neither of these occurs in appreciable amounts, a colossal tonnage of water must be passed through the sponge's canal system in order to obtain sufficient mineral material to enable the cells to secrete spicules. It has been estimated that silica, for example, is present in sea water as one part in about sixty-six thousand; hence to make one ounce of spicules, a ton of water must be drawn through the sponge body.

The cells concerned are called scleroblasts (skeleton-formers). The body wall of a sponge is made up of a dermal epithelial layer on the outside and gastral epithelium on the inside, with a middle layer or mesoglea between, of a jelly-like consistency and containing many wandering cells or amoebocytes. Some students of sponge histology regard the scleroblasts as belonging to an inner division of the dermal epithelium, others consider them to be a form of amoebocyte. Some observations indicate that a single scleroblast may form a complete spicule of either the monaxon or triradiate type, but apparently the commoner method involves the cooperative labor of two or more of these cells. In the first case, a slender thread of organic material is first secreted as a core, within the protoplasm of a single scleroblast. Around this core the mineral, lime or silica, is next deposited, and finally the spicule is enveloped by a fine sheathing of organic secretion.

In the second case, a scleroblast divides into two, each secreting half a monaxon spicule, which is within their protoplasm at first, but soon outgrows them; as they move apart they pay out the spicule between them. Three cells come



Hexaxon spicules, unmounted, dry, photographed by diffused light, 60X.

together in the manufacture of some types of triaxon spicules, each making one of the three prongs as they separate from one another. They are joined later by a fourth cell if the spicule is to be a tetraxon.

When completed, the spicules form a loosely jumbled mass, like a pile of jackstraws; a flimsy skeleton, yet one that appears to be adequate for the amount of support required. Deep-sea species have a much more complex skeleton, woven and interlocked and resembling spun glass, since the water pressure in their environment is great. As to occurrence of types, long monaxon spicules line the osculum, or principal opening of a sponge, standing erect like closely set pickets of a fence; short monaxons are found in the walls and around the small incurrent pores of many species. Triaxons are among the most abundant kinds and make up the bulk of the body wall, two rays pointing toward the osculum at the apex, the third toward the attached base. In tetraxons, the fourth ray projects inward toward the gastral cavity.

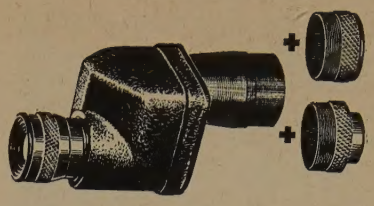
Spicules are not limited to sponges. Similar structures, sometimes known by distinctive names, are found in the radiolaria, alcyonaria, holothuria, and compound ascidians. In addition to strengthening the body wall of sponges, which would otherwise collapse into a shapeless mass, with closed pores, unable to perform the various functions required by their mode of living, spicules render sponge tissues inedible by predators.

In preparing these fairy implements of sponge masonry for microscopic mounts, it is best to know the classification of the sponge at hand, since the treatment varies. Either fresh or dried sponges may be used. If the type is unknown, remove a small piece and boil it for several minutes in strong nitric acid, then wash the resulting debris through several changes of water. Allow the spicules to settle to the bottom of the vessel before pouring off the supernatant liquid in making these changes. This treatment will clean siliceous spicules but completely destroy the calcareous ones. If none are found, boil another sample of the material in ten percent potassium hydroxide. This will clean calcareous spicules but, while it does not destroy them, it will not property clean the siliceous ones.

Having determined the composition of the spicules of the sponge being processed, boil the main mass in either the acid or the base, as indicated, and wash thoroughly through a number of changes of water, with the spicules settling to the bottom after each change before pouring off the murky mass above them. If desired to store the cleaned spicules before mounting, keep them in 70% alcohol.

Two forms of mounts may be made, strew slides and arranged slides. Strew slides, as the name indicates, contain spicules scattered about at random and may be designed to show either the various spicule types present in a single sponge species, or spicule types as such, regardless of source. With either freshly-prepared spicules in water, or stored specimens in alcohol, place a half-pipetteful on a slide and allow to dry thoroughly over gentle heat or a warm plate. Add balsam and a cover glass, using thin props for the cover if any of the spicules are three dimensional. In arranged slides, dry examples of the desired type of spicule are picked up from pill boxes, vials, or other containers, using a cat's whisker or camel's hair brush, and transferred to a predetermined location on a balsam-coated slide. When all spicules are in place, the slide is covered with an inverted tumbler and the balsam allowed to harden while protected from dust. When dry and firm, so that the spicules will not shift their position, add a light coat of thin balsam and a cover glass. Suitable props in this work include small bits of broken cover glass or of horsehair.

Sponge spicules can be combined with other hard objects that do not require fixing in the making of arranged and exhibition slides. Monaxons, anchors, double anchors, and other elongate types make radii of geometrical patterns, triaxons make intersections. Used with diatoms, foraminifera, radiolaria, holothurian anchors and plates, or butterfly and moth eggs in various combinations, some marvelous effects may be obtained. Such slides photograph and project beautifully, but must be used with great caution lest the heat of the illuminant melt the mountant to the point that the specimens will drift out of alignment. Keep the slide flat, not on edge, and do not leave the light on any longer than necessary. Always store spicule slides in flat position; if placed on edge in the usual slotted box, the spicules are certain to drift toward one edge of the cover in the course of time.



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BEGINNER'S PRIMER

Among the more familiar insects, known to everyone who has visited a shady or damp woodland or the borders of a marsh, are the crane flies, sometimes called daddy-long-legs, although this term is more commonly applied to harvestmen, an order related to spiders. They look like giant mosquitoes, being often large, slender, and with very long wings and legs; they fly slowly or in an uncertain fashion, and frequently gather in great clouds of individuals as night approaches and dance up and down in the air, like midges.

These flies are members of the Family Tipulidae, or one of the several closely-related families, a large group of more than 6000 species found all over the world, even ranging into the arctic or at high altitudes. Some species are small and, while most of them are harmless, a few have larvae that are very destructive to such crops as alfalfa, since they are root feeders. These soil larvae are mostly about one inch long, are a dirty grayish-white in color, and with a thick and tough body wall, earning them the common name of leatherjackets. Certain other crane fly larvae are aquatic, including those of the giant crane fly, *Holorusia rubiginosa,* which attain the huge size, for an immature insect, of 55 mm.

This is one of the best families of flies in which to see the halteres, the vestigial second pair of wings. The mouthparts are conspicuous and the antennae of males may be either serrate or pectinate, often very long. Interesting whole mounts may be made of the head, mouthparts, male antenna, wings, halteres, and legs of various species.

The Family Psychodidae includes diptera variously known as sand flies or moth flies, since many of them resemble small moths, the wings being densely clothed with hairs. Most species are less than 5 mm. in length, and hold the wings sloping to the sides and rear to give the insect a triangular outline. They are generally brown, with spotted wings, small heads, and long antennae with dense whorls of hairs. Some species have larvae that live in drain pipes, the adults emerging through the vents of sinks and bathtubs and culstering at the windows of houses, where they are easily captured.

Most moth flies are harmless, but those of the genus *Flebotomus* (formerly spelled *Phlebotomus*) are bloodsuckers known as sand flies, although this name is also applied to other insects of related families. *F. papatasii* is the vector ("carrier") of Three-day or Pappataci Fever in southern Europe, while other species are vectors of Oroya Fever or Carrion Disease and of its cutaneous form, Verruga Peruviana, in South America, of Espundia in Central and South America, and of Leishmaniasis or Kala-azar in the Orient. This last named is a terrific disease that has frequently erupted into severe epidemics. While the role of various species of *Flebotomus* as vectors of this scourge had long been suspected, definite proof was not forthcoming until so recently as 1942. There are one or two species of this dangerous genus within the United States, but thus far they have not been incriminated as agents in the spread of any disease.

Principal slides to prepare in this family would include whole mounts of entire adults and larvae, and of male antennae and wings.

HISTORICAL OUTLINE

In discussing the historical development of any science, the subject can be treated as an entity only through the pioneering period; thereafter it is not possible to write a connected account of the whole, but each of its complex subdivisions have to be followed separately. Thus, with bacteriology, after our preceding outline of the golden age of the Big Three—Pasteur, Koch, and Lister—further progress must be explained by pursuing in turn the many forks in the road that unfolded rapidly after the broad principles had been laid down.

One of the first essentials in getting at the complete picture of a group of organisms is to discover a natural system of classification for them. Taxonomy is primarily a tool, like the invention of suitable instruments or culturing methods. No true conception of bacteria is possible until their nature and their relationships to other organisms and to each other have been formulated. This natural assemblage proved exceedingly difficult, and even today there is considerable uncertainty and many differences of opinion as to their correct classification. Actually there is no scheme of classification beyond the primary divisions that is generally accepted.

After the discovery of microorganisms by Leeuwenhoek, the Danish zoologist, O. F. Müller, studied bacteria and added many structural details. One of his publications, in 1786, depicted several kinds so accurately that they can be identified today. Ehrenberg, in 1838, wrote a treatise on the "infusion animals" in which he introduced a basic classification and separated bacteria from some of the protozoa, with which they had heretofore been lumped. Preceding Pasteur, a number of investigators, including Dujardin, Cohn and Nägeli, ascertained a number of important facts about the physiology and development of bacteria and attempted classification of the group, but all of this work lumped together was of much less significance than that of the master, Pasteur.

In 1884, the Danish worker, Gram, found that if anthrax bacilli were stained with Ehrlich's methyl violet and then treated with iodine, the violet dye became "fast" and could not be removed, even with alcohol. When he tried this method with certain other bacteria, however, he was confronted with the result that the stain was sometimes fast and sometimes not. In some species, alcohol removed the color completely, and it was then even possible to restain the organisms with an entirely different dye. Further study showed that all typical bacteria could be divided into two great groups on this basis, and this fundamental method by which bacteriologists begin the task of identification of an unknown bears the name of the Gram stain; those species which retain the dye are termed gram-positive, those that do not are gram-negative. Thus began a separation of types on a physiological rather than the time-honored morphological basis.

After prolonged investigation and controversy, the accepted explanation of this phenomenon at the present time is that the gram-positive species have a particular chemical surface structure which is absent on the gram-negative types. It has been possible to remove this envelope by treating the cells with bile, and then they stain as do gram-negative forms. Lowering the *pH* of the medium will also reverse the gram-positive reaction. Hence it has been shown that what appeared to be a physiological separation of groups is really morphological. Churchman, who developed this concept, presented the notion that the protoplasm of all bacterial cells is gram-negative, and that some are covered with a gram-positive envelope; or, as it has been stated in other terms, the gram-positive species have gram-negative medulla and gram-positive cortex.

The Ziehl-Neelsen acid-fast staining technique, and special methods for staining capsules, spores, and flagella, when present, demonstrate differences between various kinds of bacteria and are extremely useful. Polychrome dyes, i.e., those containing two or more coloring agents, will stain some objects one color, others a different hue, as in the well-known Wright's stain for blood. For example, Pappenheim's polychrome stain for pus contains methyl green and pyronine and will stain bacteria bright red and nuclei of white blood corpuscles blue when applied to a pus smear. Thus, the primary separation of bacterial species is on a chemical basis which demonstrates or reflects structural differences.

So positive and appreciative was the reaction to the "Vocabulary for Parasitology and Public Medicine," compiled by Dr. Corrington and published in this Department in April, that reprints have been made of it in the form of a handy little folder. Indications are that teachers of biology and zoology may wish to have a supply of copies for distribution to students in their classes. Hence copies are now available in lots of one hundred, or multiples thereof, at $3.00 per hundred. Order from The American Nature Association, 1214 16th Street, N.W., Washington 6, D. C.